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Modeling of PEM fuel cell with reformate feed

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***Abstract*—**Fuel gas containing Carbon monoxide severely degrades the performance of the PEM fuel cell. To evaluate the effects of such feed, a two-dimensional, single-phase and non-isothermal carbon monoxide poisoning model for PEM fuel cell has been developed based on the conservation of mass, momentum, species, electrical charge and energy as well as adsorption, desorption and electro-oxidation kinetics. These equations solved with finite element method and good agreement seen between modeling and experimental results. The simulated results show that increasing the anode overpotential, increases the fractional coverage of catalyst surface by Hydrogen. In addition, inert gases like CO_2 have too low effect than CO on polarization curve.

***Keywords*—**Fuel cell, Reformate, Poisoning, Modeling.

I. Introduction

Hydrogen is the main fuel for PEM fuel cells. It has excellent electrochemical reactivity and provides high levels of power density that has no emission characteristics. Nevertheless, distribution and storage difficulties currently pose serious disadvantages to the use of pure Hydrogen as the feed for fuel cells in automotive propulsion [1]. Recently, before the widespread use of pure Hydrogen as fuel cell feed, the new approach is to develop fuel cells fed with reformate, which is a H_2 rich gas obtained from a liquid Hydrocarbon fuel processing system, fed with fuels such as methanol or gasoline. This gas mixture contains about 70% H_2, 24% CO_2, 6% N_2, and traces of CO (about 10-100 ppm). For using this gas mixture as fuel cell feed, it is necessary to understand the impact of non-Hydrogen components.

At typical operating temperature of PEM fuel cell that below 100°C, a near to complete layer of Carbon monoxide is formed on the Pt or Pt-alloy catalyst [2]. This CO-layer prevents Hydrogen oxidation reaction and therefore it must be proceed on the remaining free sites of catalyst layer. Studies indicate that CO coverage at 80 °C and a CO content of 50 ppm is about $\theta_{CO} \approx 0.999$. This phenomenon called catalyst poisoning. Furthermore, N_2 and CO_2 in reformate has a significant effect on the performance of fuel cell, which is called the voltage loss due to the dilution of the reactant specie, i.e. Hydrogen. This catalyst poisoning combined with the dilution of Hydrogen, can significantly decrease the performance of fuel cell. To overcome these problems and improve the performance, several approaches have been proposed. One of these cases is improving anode electrocatalysis of fuel cell and using Pt-based alloy such as Pt-Ru, Pt-Mn, Pt-Sn, etc. In comparison to platinum, these alloys are more resistant to poisoned by CO [3]-[5]. Another way is increase the operating temperature of the fuel cell, because CO adsorption on Pt or Pt-alloy catalysts is exothermic and increasing the temperature leads to a decrease in CO coverage of the catalyst. Unfortunately, the ionic conductivity of PEM fuel cell membrane is strongly dependent on the water content of the membrane, and at temperatures above 100 °C, drying of the membrane can occur, resulting in conductivity loss. The most effective method up to now to improve the CO tolerance of the PEM fuel cell at operating temperatures below 100 °C is the injection of small amounts (in the percent order) of Oxygen or air into the CO-containing fuel stream prior to feeding it to the cell. This method is referred to as "air-bleeding" or "O_2-bleeding" and was discovered by Gottefeld et al. [6]. The injected Oxygen adsorbs on the free catalyst sites and during a reaction with CO_{ads}, form CO_2, which desorbs and then Hydrogen can be oxidized.

Due to the complexity of the equations in the presence of reformate (despite extensive laboratory studies), few papers published in this field. Springer et al. [7] developed a one-dimensional model and investigated CO tolerance of the Pt anode catalyst. In this model, four overall reactions were considered for the adsorption and electro-oxidation of CO and H_2. A sensitivity analysis of several kinetic parameters that affect the amount of CO coverage and H_2 electro-oxidation was performed. Zhang et al. [8] investigated the influence of the anode flow rate and cathode oxygen partial pressure on the PEM fuel cell performance in the presence of CO. They concluded that by increasing anode inlet flow rate, the anode overpotential is increased and thus, the performance of the cell decreased. They also reported that oxygen crossover through the membrane is partly responsible for the removal of CO from the anode catalyst surface. In a study by Chu et al.

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[9], a one-dimensional transient mathematical model is applied to simulate the Carbon monoxide poisoning effect on the performance of a PEM fuel cell. The results show that the Hydrogen coverage decreases with the time due to CO adsorption on the catalyst sites. Also, a higher CO concentration results in fewer available catalyst sites for Hydrogen electro-oxidation and a significant decrease in the response time to reach steady state. In one of the latest papers published in the field of fuel cell modeling with CO-containing feed [10], a two-dimensional, isothermal and single-phase model is developed. Linear and bridged-bonded adsorbed CO modes were considered to occur in parallel.

In the present study, a two-dimensional, single-phase and non-isothermal CO poisoning model of PEM fuel cell is developed which considers detailed electrochemical kinetics in the anode catalyst layer. This model solved with CFD based on finite element method and results verified by experimental data [11]. Different grid distribution used and observed results were grid independent.

II. COMPUTATIONAL DOMAIN

The computational domain of the present model is shown in Fig. 1. This domain constitutes the anode, cathode and electrolyte regions.

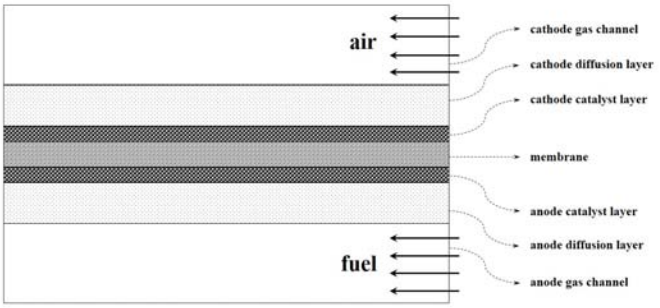

Fig. 1 two-dimensional computational domain

III. MODEL ASSUMPTIONS AND GOVERNING EQUATIONS

The assumptions adopted in the present model are: (1) the fuel cell operates under steady-state conditions, (2) all gas mixtures are an incompressible ideal fluid, (3) the flow in the channels is laminar, (4) the porous media including membrane, catalyst layers and GDLs are isotropic and homogeneous, and (5) water exist only in the vapor phase, therefore single-phase assumption apply.

The conservation equations of mass, momentum, species, electrical charge and energy are developed. They are in the following forms:

$$\nabla.(\rho\vec{u}) = S_m \tag{1}$$

$$\frac{1}{\varepsilon}\nabla.(\rho\vec{u}\vec{u}) = -\nabla p + \frac{1}{\varepsilon}\nabla.(\mu\nabla\vec{u}) + S_u \tag{2}$$

$$\nabla.\left[-\rho\omega_i\sum_{j=1}^{N} D_{ij}^{eff}\left(\nabla y_j + (y_j-\omega_j)\right)\frac{\nabla p}{p}\right] + \nabla.(\rho\omega_i\vec{u}) = S_k \tag{3}$$

$$\nabla.(-\sigma_s^{eff}\nabla.\phi_s) = S_{\phi,s} \tag{4}$$

$$\nabla.(-\sigma_m^{eff}\nabla.\phi_m) = S_{\phi,m} \tag{5}$$

$$\nabla.(\rho C_p\vec{u}T) = \nabla.(k^{eff}\nabla T) + S_T \tag{6}$$

Source terms for above governing equations can be found in [12] for various sub-regions of the fuel cell. In these equations, some parameters and variables need to be further determined. They are describe as follows.

In (2), μ is the dynamic viscosity of gas mixture and calculate from (7):

$$\mu = \sum_{i=1}^{N}\frac{y_i\mu_i}{\sum_j y_j\Psi_{ij}} \quad , \quad \Psi_{ij} = \frac{\left[1+\left(\mu_i/\mu_j\right)^{0.5}\left(M_i/M_j\right)^{0.25}\right]^2}{\left[8\left(1+M_i/M_j\right)\right]^{0.5}} \tag{7}$$

in this equation, μ_i is the viscosity of pure specie i which is temperature dependent and the constants were given in [13].

$$\mu_i = A_i + B_iT + C_iT^2 + D_iT^3 + E_iT^4 \tag{8}$$

The binary diffusion coefficients in (3) are dependent on temperature and pressure and can be calculated according to empirical relation developed by Reid & Sherwood. This equation is modified using Bruggman correlation to account for porous media, which can be expressed as (10):

$$D_{ij} = \frac{0.0018583T^{3/2}}{p(\sigma_{ij})^2\Omega_{D,ij}}\sqrt{\frac{1}{M_i}+\frac{1}{M_j}} \tag{9}$$

$$D_{ij}^{eff} = \varepsilon^{1.5}D_{ij} \tag{10}$$

The proton conductivity of membrane can be calculated from (11):

$$\sigma_m = (0.5139\lambda - 0.326)\exp\left[1268\left(\frac{1}{303}-\frac{1}{T}\right)\right] \tag{11}$$

in this equation, λ is the membrane water content and is related to the water vapor activity:

$$\lambda = \begin{cases} 0.043 + 17.81a - 39.85a^2 + 36.0a^3 & 0 < a \le 1 \\ 14 + 1.4(a-1) & 1 < a \le 3 \\ 16.8 & a > 3 \end{cases} \tag{12}$$

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$$a = \frac{y_{H_2O} p}{p_{H_2O}^{sat}} \tag{13}$$

In porous media region, Bruggman correlation was used for conductivity:

$$\sigma_s^{eff} = \varepsilon^{1.5}\sigma_s \quad , \quad \sigma_m^{eff} = \varepsilon^{1.5}\sigma_m \tag{14}$$

In the energy conservation equation, *k* represent the thermal conductivity of the gas mixture and has a relation like dynamic viscosity:

$$k = \sum_{i=1}^{N} \frac{y_i k_i}{\sum_j y_j \Psi_{ij}} \quad , \quad \Psi_{ij} = \frac{\left[1+\left(k_i/k_j\right)^{0.5}\left(M_i/M_j\right)^{0.25}\right]^2}{\left[8\left(1+M_i/M_j\right)\right]^{0.5}} \tag{15}$$

Where k_i is the thermal conductivity of pure specie *i* and calculated from (16):

$$k_i = A_i + B_i T + C_i T^2 + D_i T^3 + E_i T^4 \tag{16}$$

the constants of this equation were given in [13].

In porous media, the effective thermal conductivity is given as:

$$k^{eff} = \left(\frac{k_s}{k}\right)^{1-\varepsilon} + 3\varepsilon(1-\varepsilon)\left(\frac{\frac{k_s}{k}-1}{\frac{k_s}{k}+2}\right) \tag{17}$$

Where k_s represent the thermal conductivity of solid phase.

The specific heat capacity of the gas mixture in the energy conservation equation is determined with:

$$C_p = \sum_{i=1}^{N} y_i \left(C_p\right)_i \tag{18}$$

Where $(C_p)_i$ is the specific heat capacity of pure specie *i*:

$$(C_p)_i = A_i + B_i\left(\frac{T}{1000}\right) + C_i\left(\frac{T}{1000}\right)^2 + D_i\left(\frac{T}{1000}\right)^3 \tag{19}$$

the constants of this equation were given in [14].

The current density in cathode is calculated using the Butler-Volmer equation:

$$i_c = A i_{0,c}^{ref}\left(\frac{C_{O_2}}{C_{O_2}^{ref}}\right)\times\left\{\exp\left(\frac{\alpha_a F}{RT}\eta_c\right) - \exp\left(\frac{-\alpha_c F}{RT}\eta_c\right)\right\} \tag{20}$$

The temperature dependence of the ORR kinetic parameter is approximated as follows:

$$Ai_{0,c}^{ref}(T) = Ai_{0,c}^{ref}(353.15K)\times\exp\left\{-16456\left(\frac{1}{T}-\frac{1}{353.15}\right)\right\} \tag{21}$$

It can also be shown that the effective Pt surface area is:

$$A = \frac{6 m_{Pt}}{H_{cl}\rho_{Pt} d_{Pt}} \tag{22}$$

The expressions of overpotential and thermodynamic equilibrium potential for cathode side can be defined, respectively, as:

$$\eta_c = \phi_s - \phi_m - V_{OC} \tag{23}$$

$$V_{OC} = 1.229 - 0.83\times10^{-3}(T-298.15) + 4.3085\times10^{-5} T\times\left[\ln(p_{H_2}) + \frac{1}{2}\ln(p_{O_2})\right] \tag{24}$$

IV. Modeling of Catalyst Poisoning by CO

As mentioned before, in the presence of CO at the anode, part of the catalyst surface is covered by CO that causes site exclusion and reduces the number of active catalyst sites available for the HOR. Thus, for CO poisoning analysis, the anode kinetic equations Should be modified. Springer et al. [7] suggested, in the presence of CO, four kinetic steps on the anode (where M denotes a vacant catalyst site):

$$CO + M \underset{b_{fc}(\theta_{CO})k_{fc}}{\xrightarrow{k_{fc}}} (M-CO) \tag{25}$$

$$H_2 + 2M \underset{b_{fh}k_{fh}(\theta_{CO})}{\xrightarrow{k_{fh}(\theta_{CO})}} 2(M-H) \tag{26}$$

$$(M-H) \xrightarrow{k_{eh}} H^+ + e^- + M \tag{27}$$

$$H_2O + (M-CO) \xrightarrow{k_{ec}} M + CO_2 + 2H^+ + 2e^- \tag{28}$$

The first two processes that occur simultaneously, represent adsorption of CO and H_2 on catalyst, respectively. These two reactions compete for the vacant catalyst surface. The poisoning effect of CO is mainly due to the chemical reaction represented by (25) and due to this reaction, the part of the catalyst surface that adsorbs CO is unavailable for chemical reaction represented by (27) and (28). The third and fourth equations correspond to H_2 and CO electro-oxidation, respectively.

By writing species balance law for CO and H_2, expressions for θ_{CO} and θ_H that respectively represent the fractions of catalyst layer adsorbed by CO and H_2 can be found. Because of the steady state modeling, the transient terms of these equations are equal to zero:

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$$\rho\dot{\theta}_{CO} = k_{fc}p_{CO}(1-\theta_{CO}-\theta_{H_2}) - b_{fc}k_{fc}\theta_{CO} - k_{ec}\theta_{CO}e^{\frac{\eta_a}{b_c}} = 0 \quad (29)$$

$$\rho\dot{\theta}_{H_2} = k_{fh}p_{H_2}(1-\theta_{CO}-\theta_{H_2})^n - b_{fh}k_{fh}\theta_{H_2}^n - k_{eh}\theta_{H_2}\left(e^{\frac{\eta_a}{b_h}} - e^{-\frac{\eta_a}{b_h}}\right) = 0 \quad (30)$$

In the above equation, n is the intermediate Hydrogen step in catalyst site. In this work, we consider first order, i.e. $n=1$. If all rate constants are independent of θ_{CO}, i.e. k_{fh} and b_{fc} are constant, then by solving this system of equations, the values of θ_{CO} and θ_H can be found. Finally, the current densities for H_2 and CO oxidation were calculated from:

$$i_{H_2} = 2k_{eh}\theta_{H_2}\left(e^{\frac{\eta_a}{b_h}} - e^{-\frac{\eta_a}{b_h}}\right) \quad , \quad i_{CO} = 2k_{ec}\theta_{CO}e^{\frac{\eta_a}{b_c}} \quad (31)$$

where $b_h=b_c=2RT/F$.

Then the total current within the anode catalyst layer becomes:

$$i_a = a(i_{H_2} + i_{CO}) \quad (32)$$

At this layer, the source terms for H_2 and CO are:

$$S_{H_2} = \frac{-M_{H_2}}{2F}i_{H_2} \quad , \quad S_{CO} = \frac{-M_{CO}}{2F}i_{CO} \quad (33)$$

To conduct the modeling simulation, a great number of parameters are required. These parameters for basic case are provided in Table 1.

V. Boundary conditions

In order to solve the equations presented in the previous section, the appropriate boundary conditions should be prescribed. In this modeling, single-domain method was used, therefore it is not necessary to specify interface conditions between various cell layers. Thus, at all outside borders we apply zero flux condition, except for inlet and outlet of gas channels. At the inlets on both the anode and the cathode sides, the values of velocity, pressure, mole fractions of species and temperature are prescribed. At the outlets of both channels, the value of pressures are prescribed.

After defining the above boundary conditions, the governing equations were solved with finite element method and the following results were obtained.

Table I model parameters for basic case

Parameter	Symbol	Value
Gas channel length	L	*10 mm*
Gas channel height	H_{ch}	*1 mm*
Diffusion layer height	H_{gdl}	*0.26 mm*
Catalyst layer height	H_{cl}	*0.0287 mm*
Membrane height	H_m	*0.051 mm*
Gas inlet temperature	T_{in}	*358.15 K*
Anode/Cathode pressure	p_a/p_c	*50/60 psig*
Relative humidity of inlet fuel	$RH_a\%$	*100%*
Mole fraction of inlet Oxygen	y_{O2}	*0.11226*
Mole fraction of inlet Hydrogen	y_{H2}	*0.87029*
Porosity of diffusion layer	ε_{gdl}	*0.4*
Porosity of catalyst layer	ε_{cl}	*0.4*
Porosity of membrane	ε_m	*0.28*
Pt mass loading	m_{Pt}	*0.5 mg/cm^2*
Pt particles diameter	d_{Pt}	*2.8e-9 m*
Pt density	ρ_{Pt}	*21450 kg/m^3*

VI. Results

The model validated by comparing the model results with experimental data provided by Ehteshami et al. [11]. The computed polarization curves shown in Fig. 2 is in good agreement with experimental polarization curves.

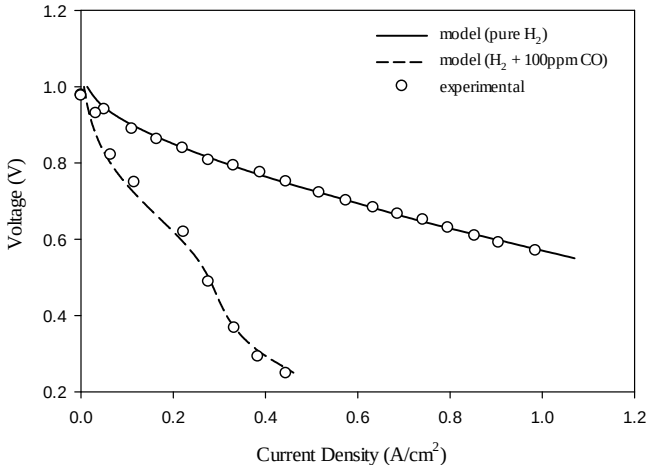

Fig. 2 comparison of model and experimental polarization curves

Fig. 3 shows fractional coverage of catalyst surface by H_2. As the anode overpotential increases, the onset potential for CO electro-oxidation is eventually reached. Therefore, CO-free catalyst sites are created. As a site is uncovered by oxidative stripping of CO, many hydrogen turnovers occur before another CO molecules adsorbs to block the site. This

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leads increasing in θ_H.

Fig.4 shows the effect of CO_2 on polarization curves. It can be seen that the effect of CO_2 on the polarization curve is much lower than CO (compare 70% H_2/30% CO_2 with 100% H_2/100ppm CO). It is because that, unlike carbon monoxide, CO_2 do not participate in the electrochemical reaction and is therefore inert.

The distribution of Carbon monoxide molar concentration in the middle of anode gas channel is shown in Fig. 5. Along the flow direction, as CO be oxidized, the concentration of Carbon monoxide is reduced.

A comparison of the distribution of O_2 molar concentration in the middle of cathode gas channel for two cases of pure Hydrogen and reformate in V_{cell}=0.6 are shown in Fig. 6. It is clearly seen that the decrease in oxygen concentration is more for the case of pure hydrogen. The reason is that in this case, the fractional coverage of catalyst surface by CO is zero and thus the rate of Hydrogen oxidation will be maximum and therefor the cell overall reaction increased and more Oxygen consumed.

In Fig. 7 a comparison of current density vs. anode overpotential characteristics for Hydrogen and Carbon monoxide oxidation reactions is shown. As can be seen, the values of current for CO oxidation are too low than H_2 oxidation.

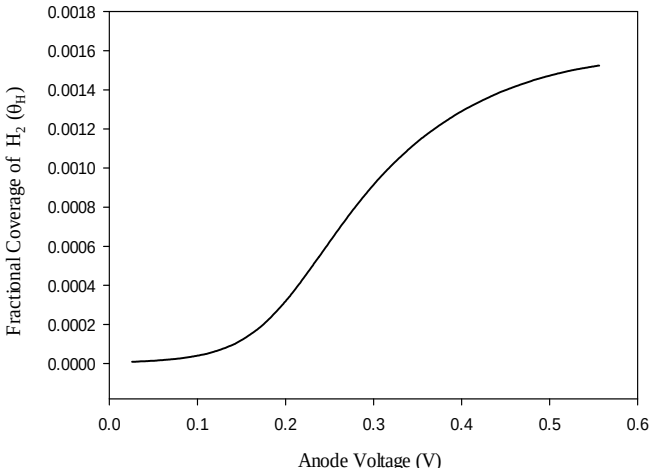

Fig. 3 fractional coverage of catalyst layer by Hydrogen

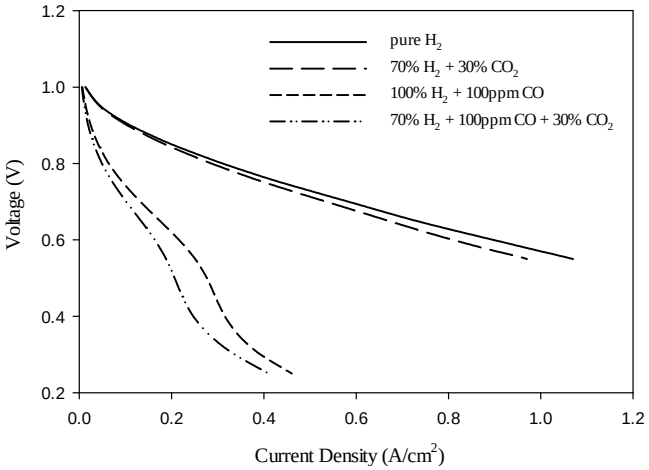

Fig. 4 effect of CO_2 on polarization curves

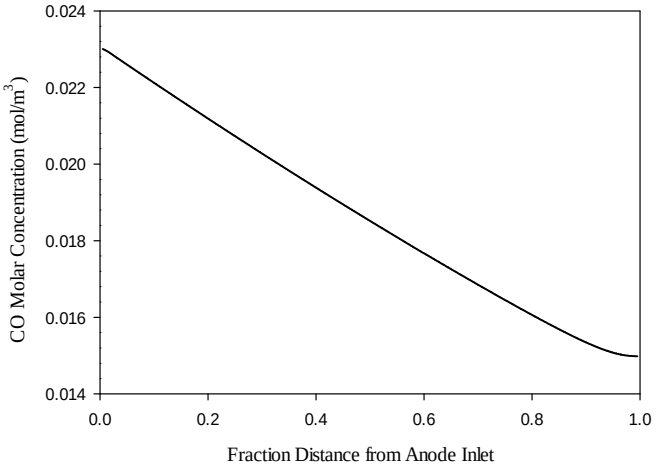

Fig. 5 distribution of CO molar concentration along the anode gas channel at V_{cell}=0.6

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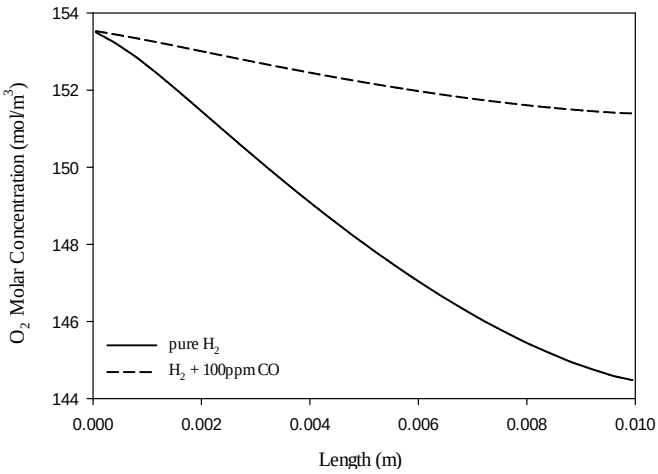

Fig. 6 distribution of O_2 molar concentration along the cathode gas channel for pure Hydrogen and reformate at V_{cell}=0.6

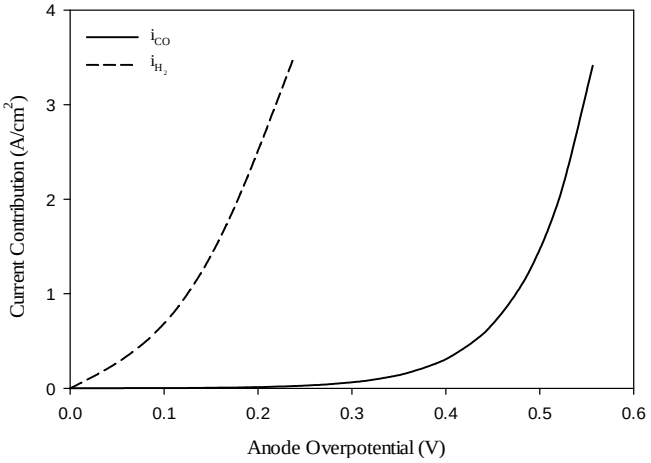

Fig. 7 current contribution of H_2 and CO electro-oxidation

VII. CONCLUSION

A two-dimensional, single-phase and non-isothermal carbon monoxide poisoning model for PEM fuel cell has been developed based on the conservation of mass, momentum, species, electrical charge and energy as well as adsorption, desorption and electro oxidation kinetics. These equations are solved using CFD based on finite element and seen that the predicted results are in good agreement with experimental data. The simulated results show that increasing the anode overpotential, increases the fractional coverage of catalyst surface by Hydrogen. This model capable of studying the effect of Hydrogen dilution due to the inert gases as well as the effect of CO poisoning. Results indicate that inert gases like CO_2 have too low effect than CO on polarization curve. Also, if reformate feed is used instead of pure Hydrogen, less Oxygen will be consumed.

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Modeling of photovoltaic panel using datasheet parameters

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***Abstract*—**the growing number of the PV panels that share power supplying all over the world makes it essential to have a model of panels to be utilized in further analyzing. In this study a single diode model, which is simple and accurate, is created for PV panel. The parameters that need to be extracted from datasheet specification in modeling of PV panel include photovoltaic current (I_{PV}), diode reverse saturation current (I_0), diode ideality constant (a), series resistance (R_S), and parallel resistance (R_P). For simplicity some authors eliminate the parallel resistance or both the series and parallel resistance, but these resistances have significant effect on PV model accuracy and its better not to be eliminated. This paper proposes an iteration procedure to estimate the amount of these resistances by changing the values of resistances to match the maximum power point with maximum power point voltage. Two different commercial PV modules with different technology (monocrystal and multicrystal) are selected and modeled in MATLAB/ SCRIPT. Their predicted output values at nominal operating cell temperature (NOCT) provided by proposed model are compared with the NOCT parameters values provided by manufacture's datasheet and their relative errors are calculated to validate the proposed model.

***Keywords*—**PV single diode model, NOCT, MATLAB, monocrystal, multicrystal.

I. INTRODUCTION

IN recent years we face the great attention for renewable energy sources. The reason comes from the harmful effects and limited sources of fossil fuels. Fossil fuels contribute to global warming, water pollution, air pollution and other harmful effects. Among all the renewable sources is photovoltaic (PV) that produces electricity directly from the irradiation of the sun. It is one of the most important characteristic of PV system that it does not need any rotating component in the process of producing energy.

In a photovoltaic solar system, the power generating devices are the PV modules, often called PV panels. The PV modules, or panels, are comprised of a number of PV cells connected in series and shunt configuration [1].

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The increasing presence of PV system in producing electrical energy also increases the analyzing for other required devices such as MPPT and inverter.

The testing of PV system faces with some difficulties. For example the irradiation of the sun that falls on the PV panel and the temperature cannot be adjusted. In addition to these difficulties, the high cost of fieldwork arises the need for PV simulation. Practical PV panel simulation requires several parameters that should be extracted from the practical panel datasheet, which is the main subject of this paper. For simplicity, the single diode model for PV cells is studied in this paper. This model offers a good comparison between simplicity and accuracy [2]. In the single diode model, the carrier recombination losses in the depletion region are not considered [3]. Some authors have used an extra diode to represent the effect of the recombination of carriers [4], [5]. A single diode model includes a photocurrent source, a parallel diode, a series resistance and a parallel resistance. The parallel resistance R_P is large and some authors eliminated the parallel resistance [6]-[9]. The value of R_S is very low, and sometimes this parameter is neglected too [10]-[12]. In this paper single diode model with five parameters will be discussed.

II. MODELING OF SINGLE DIODE PV PANELS

Fig. 1 shows the equivalent circuit of the ideal and practical single diode PV cell.

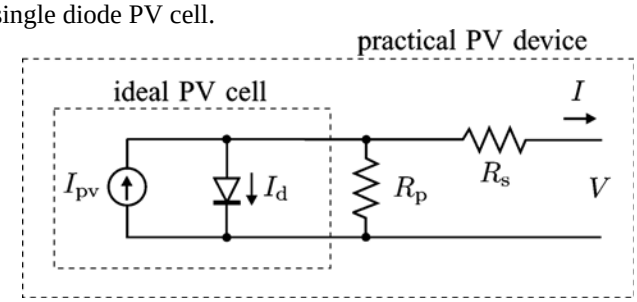

Fig. 1 single diode model of the ideal PV cell and practical PV cell including the series and parallel resistances

The basic equation from the theory of semiconductors [13] for mathematically describing the *I-V* characteristic of the ideal PV cell is

$$I = I_{PV,cell} - I_{0,cell}\left[\exp\left(\frac{qV}{aKT}\right) - 1\right] \quad (1)$$

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where $I_{PV,cell}$ is the current generated by the incident light (it is directly proportional to the sun irradiation), $I_{0,cell}$ is the reverse saturation or leakage current of the diode, q is the electron charge (1.60217646×10^{-19} C), k is the Boltzmann constant (1.3806503×10^{-23} J/K), T (in Kelvin) is the temperature of the *p-n* junction, and a is the diode ideality constant. By inclusion the series resistance R_S and parallel resistance R_P in (1) and by connecting this cells in series to make a PV panel, the *I-V* characteristic of the practical PV panel is

$$I = I_{PV} - I_0\left[\exp\left(\frac{V + R_S I}{V_t a}\right) - 1\right] - \frac{V + R_S I}{R_P} \quad (2)$$

Where $V_t=N_S KT/q$ is the thermal voltage of the panel with N_S cells connected in series. For the cases the cells are connected in parallel $I_{PV}=N_S\times I_{PV,\ cell}$ and $I_0=N_S\times I_0$ with N_P cells connected in parallel.

All of the PV panel manufacturers bring information such as the maximum power (P_{max}), maximum power voltage (V_{mpp}), maximum power current (I_{mpp}), open circuit voltage (V_{OC}), short circuit current (I_{SC}), temperature coefficient of V_{OC}, temperature coefficient of I_{SC} under standard test conditions (STC).

The above information is not enough to get the *I-V* characteristic of the PV panel. Some of the parameters that are required in simulating the PV panel and cannot be found in manufacturer's datasheet are: light generated or PV current, the diode ideality constant, the diode reverse saturation current and the series and shunt resistances.

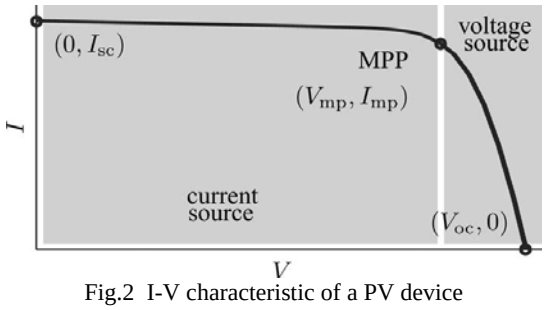

Fig.2 I-V characteristic of a PV device

Fig.2 shows the *I-V* characteristic of a PV device that has been extracted from equation (2). This curve depends on external parameters such as irradiation level and temperature and on internal parameters of the device (R_S, R_P). All of these parameters are required for simulating the PV device and they don't come in manufacture's datasheet as discussed above.

A. Light generated or PV current (I_{PV})

From analyzing fig.1 in short circuit condition it can be found that

$$I_{PV,n} = \frac{R_P + R_S}{R_S} I_{SC,n} - I_D \quad (3)$$

Where $I_{PV,n}$ is the light generated current at the standard condition (usually 25 ^{0}C and 1000W/m^2) and I_D is the diode current. The voltage of the diode is low, so I_D is neglected. In practical panels the series resistance is low and the parallel resistance is high, then the following assumption is generally used in the modeling of PV devises

$$I_{PV,n} \approx I_{SC,n} \quad (4)$$

The light generated current of PV cell depends linearly on the solar irradiation and is also influenced by the temperature according to the following equation [14].

$$I_{PV} = \left(I_{PV,n} + K_I \Delta_T\right)\frac{G}{G_n} \quad (5)$$

Where I_{PV} is the light generated current at any different temperature and irradiation, K_I is the temperature coefficient of I_{SC}, G (watts per square meter) is the irradiation on the panel surface, and G_n is nominal irradiation.

B. Diode reverse saturation current (I_0)

The main equation for diode reverse saturation current may be expressed as follow

$$I_0 = I_{0,n}\left(\frac{T}{T_n}\right)^3 \exp\left[\frac{q E_g}{aK}\left(\frac{1}{T_n} - \frac{1}{T}\right)\right] \quad (6)$$

Where Eg is material band gap energy (1.12 for silicon cells), T_n is the *p-n* junction cell temperature at nominal condition, T is the *p-n* junction cell temperature [15],[16], and I_0 is the nominal reverse saturation current, which is obtained from (2) in the nominal open circuit condition ($V=V_{OC}$, $I=0$ & $I_{PV}=I_{SC}$) [14].

$$I_{0,n} = \frac{I_{SC,n}}{\exp\left(V_{OC,n}/aV_{t,n}\right) - 1} \quad (7)$$

Instead of using (6) in the computation, it may better to modify (7) by adding the temperature coefficient of voltage and temperature coefficient of current

$$I_0 = \frac{I_{SC,n} + K_I \Delta_T}{\exp\left(\left(V_{OC,n} + K_V \Delta_T\right)/aV_t\right) - 1} \quad (8)$$

Equation (8) will be used for computing I_0 in this paper.

C. Diode ideality constant (a)

a expresses the degree of ideality of the diode and it is empirical. Increasing the value of *a* effects in two ways: first, increases the curvature of the *I-V* characteristic, and secondly, leads to different values for loss resistances [2]. For simplicity we neglect the computation of this parameter. In general *a* is around 1 and 1.5 and *a* is chosen 1.3 in this paper [14].

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D. Series and parallel resistance (R_S & R_P)

The remaining unknown parameters in (2) are R_S and R_P. This paper uses the mathematical formula for P_{max} obtained from (2) in the maximum power point (MPP).

$$P_{\max} = V_{mpp}\left\{I_{PV} - I_0\left[\exp\left(\frac{V_{mpp}+R_S I_{mpp}}{V_t a}\right)-1\right] - \frac{V_{mpp}+R_S I_{mpp}}{R_P}\right\} \quad (9)$$

It can also be obtained that

$$R_P = V_{mpp}\left(V_{mpp}+R_S I_{mpp}\right)/\left\{V_{mpp} I_{PV} - V_{mpp} I_0 \exp\left[\frac{V_{mpp}+R_S I_{mpp}}{V_t a}\right] + V_{mpp} I_0 - P_{\max}\right\} \quad (10)$$

Equation (10) means that for any value of R_S there will be a value of R_P that makes the *P-V* curve cross the maximum power point. Fig.4 shows how *P-V* curve changes with the increase of R_S. As it is shown in the fig.3, V_{mpp} decreases with the increase of R_S. It means that for any value of R_S and R_P, which is get from equation (10), there is a value for V_{mpp}. But there is a specific value for V_{mpp} that comes in manufacture's datasheet. Then we can increase the value of R_S until the simulated maximum power point voltage is equal with the maximum power point voltage that comes in datasheet, and this is the proposed procedure to find the R_S and R_P.

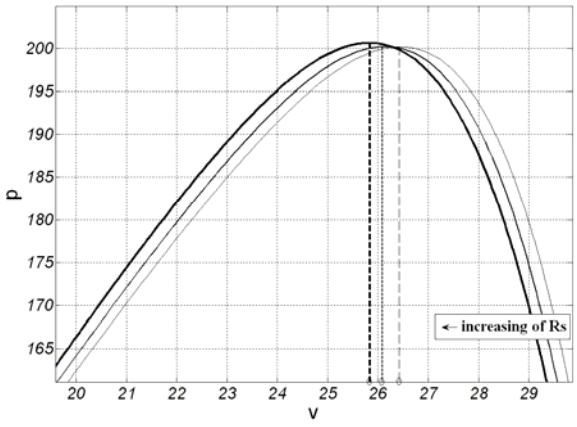

Fig.3 P-V characteristic of a PV device for various value of R_S & R_P

The iteration meted has been used to modify the values of R_S and then R_P, which is as follow:

1) Increment the value of R_S, and find the corresponding R_P from (10).

2) Find the maximum power point voltage ($V_{mpp,cal}$) from (2) by Using the calculated R_S and R_P.

3) Continue to increment R_S until $V_{mpp,cal}$ reaches the V_{mpp} that comes in manufacture's datasheet.

The calculation of R_S and R_P values and drawing of *I–V* and *P–V* curves were simulated in the MATLAB/ SCRIPTS.

III. SIMULATION AND VALIDATION

A. Simulation and results

The single diode model discussed in this paper is validated through simulating the practical PV module in MATLAB/SCRIPT, by implementing the discussed methods to find all the five parameters. The flowchart of the MATLAB/ SCRIPT program to calculate the parameters is given in fig.4.

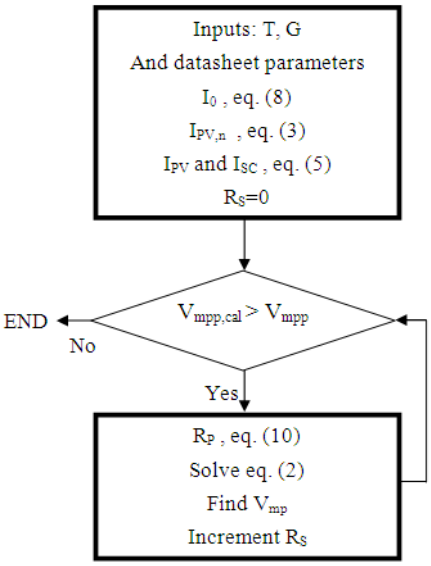

Fig.4 the flowchart of the MATLAB/ SCRIPTS program to calculate the parameters

Two different panels with different technology (monocrystal and multicrystal) from different factories are selected to validate the proposed model. Table.1 shows the datasheet parameters of these panels [16], [17]. And table.2 shows the parameters that are extracted from these panels by simulation.

Table.1 datasheet parameters of modules at standard testing condition (STC)

	KC200GT	YL205C-24b
technology	multicrystal	monocrystal
I_{MPP}	7.61 A	8.57 A
V_{MPP}	26.3 V	23.9 V
P_{max}	200.143 W	204.823 W
V_{OC}	32.9 V	30.5 V
I_{SC}	8.21 A	9.27 A
K_V	-0.123 V/°C	-0.09455 V/°C
K_I	0.00318 A/°C	0.003708 A/°C
N_S	54	48

Table.2 extracted parameters by simulation for KC200GT and YL205C-24B at STC

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parameters	KC200GT	YL205C-24b
$I_{0,n}$	$12.397*10^{-8}$	$6.4609*10^{-8}$
I_{PV}	8.21	9.27
R_S	0.224	0.263
R_P	759.7175	421.4304

Figures 5 – 12 illustrate the *I-V* and *P-V* characteristic of simulated PV panels in various irradiations and temperature.

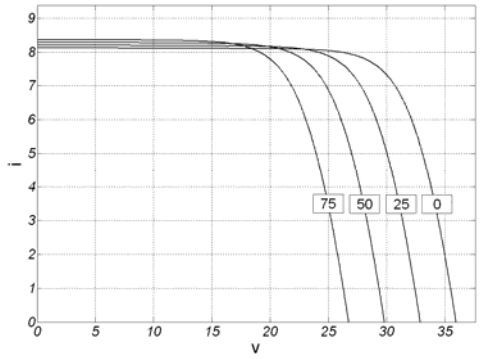

Fig.5 I-V characteristic of KC200GT PV module for the temperature variation

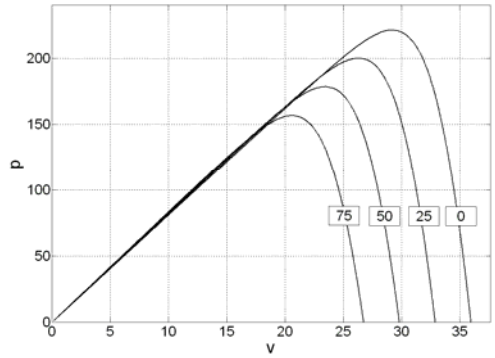

Fig.6 P-V characteristic of KC200GT PV module for the temperature variation

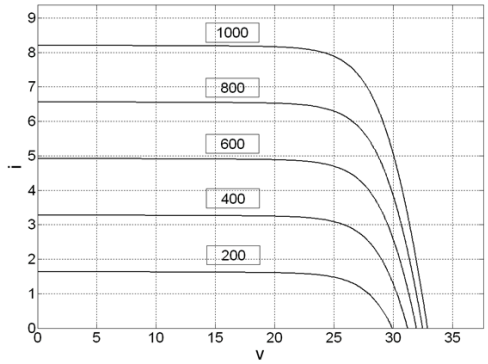

Fig.7 I-V characteristic of KC200GT PV module for the irradiation variation

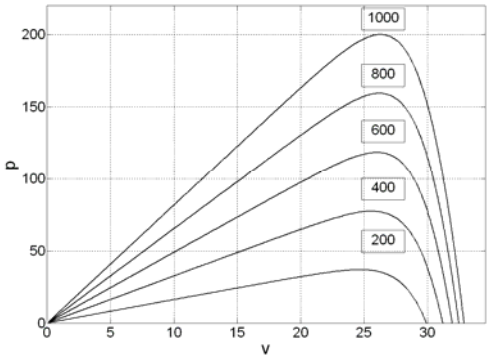

Fig.8 P-V characteristic of KC200GT PV module for the irradiation variation

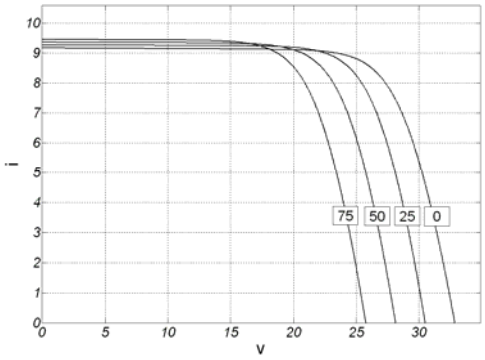

Fig.9 I-V characteristic of YL205C-24b PV module for the temperature variation

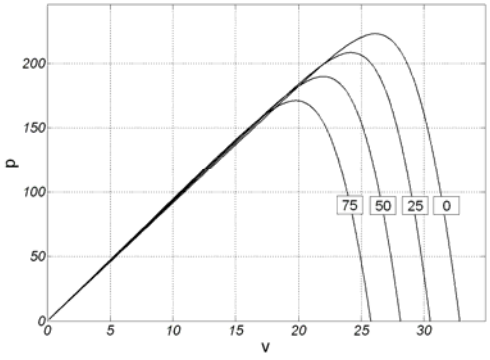

Fig.10 P-V characteristic of YL205C-24b PV module for the temperature variation

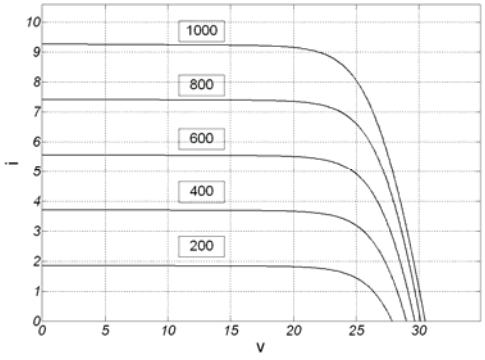

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Fig.11 I-V characteristic of YL205C-24b PV module for the irradiation variation

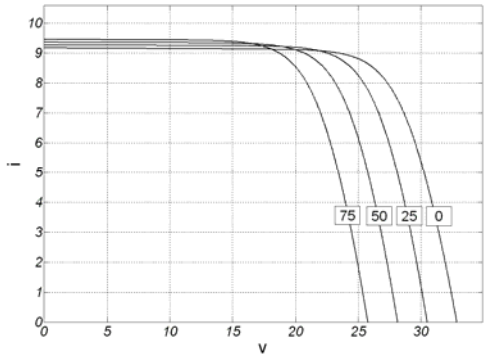

Fig.12 P-V characteristic of YL205C-24b PV module for the irradiation variation

B. Model validation with manufacture's data

Having the comparison of datasheet parameters and model output with the determined parameters is one of the best ways to see how accurate the simulated model is. Table.3 and table.4 shows the datasheet value at NOCT, predicted model output at NOCT, and the percentage error between datasheet value and the predicted model output.

The comparison results show that the errors are within 3% for P_{max} and V_{max} and even lower for other parameters.

Table.3 comparison of model output with manufacturer's datasheet at NOCT for KC200GT

	Datasheet value	Model output	Error , %
P_{max}	142W	144.36W	1.6
V_{max}	23.2V	23.9V	3
I_{max}	6.13A	6.04A	1.4
V_{OC}	29.9V	29.77V	0.43
I_{SC}	6.62A	6.62A	0

Table.4 comparison of model output with manufacturer's datasheet at NOCT for YL205C-24B

	Datasheet value	Model output	Error , %
P_{max}	149.5W	151.9W	1.6
V_{max}	21.8V	22.3V	2.29
I_{max}	6.86A	6.81A	0.72
V_{OC}	28.2V	28.13V	0.24
I_{SC}	7.48A	7.47A	0.13

IV. CONCLUSION

In this paper, a general approach on modeling photovoltaic panels is presented. The data needed for the model are from the manufacture's data sheet. Two kinds of commercial panels with different technology (monocrystal and multicrystal) were modeled and their parameters were evaluated through proposed procedure. The model accuracy is also analyzed through comparison between NOCT parameters provided by manufacture's datasheet and with the model output at NOCT. Moreover, the predicted output of the developed model matches reasonably well with experimental results and the comparison results show that the errors are within 3% for P_{max} and V_{max} and even lower for other parameters. Therefore this generalized model can be adopted for representing the performance of any PV panel at various operating conditions.

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Chemical and Biological Characterization of Animal Wastes in Livestock Industry and Offering Appropriate Management Solutions to Collect and Dispose of Them (Case Study of Dasht-e Azadegan Dairy Cattle Farm)

Souad jorfinejad , Afshin takdastan , Forozan farrokhian

***Abstract*—** One of the sources of waste production is the waste produced by the livestock industries. Animal waste contains nutrients such as nitrogen , phosphorus , potash , high percentage of organic matters , and also pathogens transmitted from animals to humans , which not only do pollute the environment in case of waste mismanagement, but also endanger public health and sanitation. This research aims to investigate bacterial properties and the amount of fecal coliform and chemical properties and the total amount of produced waste per each head of cattle with regard to their weight and the average mean of daily produced waste of the studied dairy cattle farms and also to offer management solutions for their optimal disposal. In this connection, chemical properties such as percentage of nitrogen, phosphorus, potassium, calcium per dry weight , BOD, pH , C/N ratio, total and fecal coliform rate were measured. Pathogens such as Escherichia Coli, Salmonella, Shigella, Ascaris , Balantidium Coli , Tina Saginata were identified. The fecal coliform was measured as $26x10^9$ MPN/g per dry weight. The amount of fecal wastes pr head of cattle with regard to the weight of the cattle and total amount of animal wastes was calculated in Susangerd and Hamidieh dairy cattle farms. The studied samples are Holstein dairy cows. The average amount of produced waste per each head of cow weighing 240 to 365 kg is 12.9 to 19.7 kg per day. The total amount of waste produced in Susangerd and Hamidieh dairy farms is 466.3 and 973.36 kg per day respectively. In order to compare the data, spss software was used. Scraper system and tractors equipped with blade were used to collect the waste. With regard to the climatic conditions and the soil type, biogas method and drying the compost indoors by dryer are suggested for the waste disposal.

***Keywords*—** microbial properties, animal wastes, fecal coliform, chemical properties.

Introduction

Due to the increase of population growth and society welfare, the use of food resources (animals) has increased and thus their production has increased to compensate for the demand. Development of livestock and poultry industries had led to the production of high level of animal wastes which has changed into an important challenge in many countries. Waste disposal is a major problem for most ranchers. Animal wastes contain many pathogens (bacteria, viruses, parasites) and also mutagenic compounds and resistant bacteria. Each of these germs can cause specific diseases which are transmitted to human beings and cause systemic infections in humans [3]. Moreover, if the animal waste is not drained regularly from the dairy farm where the cattle lives or if it is piled outdoor, since the newly produced manure in the dairy farms contains over 80% humidity, it is a good place for the growth of pathogens which cause animal and human diseases. Furthermore, it attracts mosquitoes, flies, and mice which can transmit pathogens in humans and the cattle. For instance, mice cause more than 35% of dangerous diseases in humans the most important of which are plague, typhus, cholera, typhoid, bite fever, diarrhea, relapsing fever, etc and sand fly which is the vector of cataneous leishmaniasis disease can live in hot humid bunkers such as the waste bulks and animal manure, stalls, and rodent nests and transmit cutaneous leishmaniasis to humans by biting them. Pathogenic bacteria can be transferred in to the soil at a large depth and preferential flows in the soil pave the route for the bacteria to penetrate into the soil depths [6]. Animal wastes contain remarkable amounts of nutrients such as phosphorus, nitrogen, potassium, and heavy metals like iron, manganese, copper, magnesium, antibiotics, and drugs used by the livestock which are major pollutants in aquatic systems and can enter groundwater and surface water via penetrating into the soil and drainage wells and cause imbalance in biological system. Nitrate can harm the fish and high concentration of nitrate can cause jaundice in children or methemoglobinemia. High phosphorus level in manure can lead to ecological imbalance in aquatic systems. Plants, especially the algae that grow at the presence of high levels

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of phosphorus, cause the accumulation of food in surface water. Algae decomposition causes depletion of oxygen in water and death of the fish [1].
Animal waste depot outdoor to be corroded, causes the release of methane and carbon dioxide in the atmosphere which can lead to the increase of greenhouse gases. In 1990, about 5% of the total methane was emitted by the manure [4]. According to the U.S. Environmental Protection Agency, in 1997 about 10% of the methane was emitted by the manure. In 2010 this rate increased to 18.4% which was due to mismanagement or inappropriate treatment of animal wastes [2]. When the animal waste is stored on the ground 80% of its nitrogen changes into ammonia and nitrous oxide. Nitrous oxide is one of the air pollutants which is 289 times stronger than carbon dioxide and ammonia causes soil acidification and increases the trees susceptibility and destroys the biodiversity. Lack of proper management of animal waste will be followed by some negative effects such as health impacts in direct contact with the waste (spread of microbial, viral, and parasitic diseases), sanitary effects due to the proliferation of insects and vermin, environmental effects (pollution of water, soil, and air), aesthetic impacts, social and economic impacts. Considering the

environmental and health impacts of animal wastes, large amount of wastes, high costs of transport and disposal, unpleasant odor, etc the need to optimal management of animal wastes is highly felt and it should be emphasized more and more in animal waste management and it should be considered on the top of livestock management agenda in livestock units and the best decisions and managerial patterns should be held for optimal management of animal wastes and decrease of economic, health, and environmental problems in the livestock units.
In Iran and in Khuzestan, there is no true control over the animal waste management in most dairy cattle farms. The estimated livestock population in Iran based on the type of cattle and province in 2010 is as the following:
Sheep and lambs: 51957099, goats and goat kids: 25679, purebred cattle: 1009, crossbred cattle: 4690, native cattle: 2711, buffalo: 47300, camel: 155000 heads (according to the Iranian livestock population data in 2010). At present, Khuzestan Province owns 7 million heads of cattle and 155 industrial dairy cattle farms, except for the traditional dairy cattle farms which are much more (according to the Iranian livestock population data in 2010). In the meantime, if the correct and fundamental management of the livestock wastes is not applied it can be seriously dangerous for the environment and public health. Since Khuzestan plain is very rich in terms of surface water resources and the groundwater level is high, the soil type is more sandy and the elevation from the sea level is 12 meters. The ranching town of Hamidieh is near the Karkheh River. Therefore, in order to prevent the pollution of surface water and groundwater it is necessary to control the resources which contaminate water such as livestock wastes and to apply true management in this regard. As a result, it seems necessary to conduct a comprehensive review in the field of waste production, collection, maintenance, transportation, and disposal in all the cattle farms. Quantitative and qualitative study of the animal wastes in cattle farms is necessary for planning facilities to collect and treat animal wastes, for selecting the most appropriate optimal disposal method with regard to the amount of produced wastes and their quality and microbial features, for ensuring the health of practitioners, human, and environment in terms of sanitary and environmental aspects, and for increasing the proceeds of the sale of the livestock wastes which can be recycled in terms of economic and technical aspects.

Research theory and Review of Literature

A research was conducted in Sanandaj to study the polluting potential of different organic fertilizers and the rate of bacteria releasing from the fertilizer treatments during the leaching time of soil-fertilizer columns. The organic fertilizers used in this research included cattle manure, poultry manure, and sewage sludge. All gram- negative bacteria and Escherichia Coli bacteria were selected as the pathogenic bacteria found in manure treatments. The density and the release of such bacteria from the manure treatments were evaluated. The concentration of gram-negative bacteria at the beginning of the leaching for the cattle manure and the poultry manure was 26795 and 540083 colonies per mg of dry manure, respectively. By leaching the manure treatments, the bacteria were released from the absorbance levels and entered the soil column together with the leaching water. The rate of Escherichia Coli bacteria which was released from the cattle and poultry manure and entered the soil was 39.2% and 15.1%, respectively. It was concluded that application of raw manure in the farm indicated the risk of surface and underground water contamination. The risk of getting contaminated is particularly more in soils which have high levels of underground water and contain a lot of coarse pores [11]. In the present research, the rate of fecal coliforms and pathogens, the amount of produced wastes per each head of cattle per day and the quality of the wastes have been examined and the most appropriate disposal method has been presented with regard to the rate of produced wastes and the region conditions.

In Iran several cases of groundwater drinking water contamination by animal manure pathogenic bacteria have been observed. In June 2004, the contamination of groundwater in a village in Chahar Mahal Bakhtiary Province caused the majority of the village residents to get sick. The analysis of the water of the wells in that area showed that the water was contaminated by Escherichia Coli bacteria and the severe infection of colon and urinary tract was due to the consumption of the water contaminated by those bacteria [11].

A research was conducted to investigate sanitary risks of new wastes and untreated livestock wastewater used for agriculture. The results showed that the untreated wastes and wastewater used for farming caused the spread of pathogens such as intestine nematodes like Ascaris, Trichuris,

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Anchlesitum, viral infections such as viral diarrhea and hepatitis A, and also microbial infections such as bacterial diarrhea and typhoid [7].
Extension services of Minnesota University in the U.S. studied the chemical properties of different types of manure used in agricultural lands in 1995. The studied parameters included sulfur, total percentage of phosphorus, potassium, nitrogen, magnesium based on dry weight, iron, copper, and zinc in mg/kg of dry weight. Comparison of the results of chemical properties of wastes in this research and abovementioned research shows that there is a difference in the amount of nutrients available in livestock wastes due to differences in diet, gender, species, weather conditions, and wastes management. A study was conducted to offer methods for animal manure management. Nutrients (total nitrogen, potassium, phosphorus) and volatile solids, and total solids were measured and in order to reduce nutrients such as nitrogen, anaerobic pond system and stabilization pond aeration system were investigated. It was concluded that nitrogen waste for anaerobic ponds was 25% and for aeration systems was about 80%. The best method for reducing nitrogen was suggested to be the use of aeration system [5]. However, the present research suggested biogas method and drying the manure by dryer with regard to chemical and microbial properties.

A research was conducted in Mashhad entitled "Comparing the quality of the manure obtained from livestock wastes and wastes of vegetables field in Mashhad in terms of the rate of minerals (phosphorus, potassium, calcium, nitrogen, etc) using biogas method in Chahchahe Village in Mashhad. The results showed that the reactor containing plant wastes did not produce gas after 4 days and did not produce any flame even after 80 days, but the biogas resulted from livestock wastes produced stable blue flame after one month. It was also concluded that the livestock wastes had the biogas potential which produced stable blue flame after one month, but the biogas system of vegetables wastes did not produce any flame within the retention time of 80 days. The manure produced from the livestock wastes in biogas method had a better quality than the vegetables compost [8].

For the plan of collection and treatment of animal wastes, a research in China examined parameters such as the amount of wet wastes in terms of the percentage of live weight per day, the percentage of total solids in terms of wet weight percentage, the needed biochemical oxygen, Potash K2O in terms of total solids percentage, total nitrogen in terms of total solids percentage, and also the produced wastes by different animals. For the treatment of animal wastes the research suggested the application of stabilization ponds via aerobic method so that 70% of the total nitrogen in the wastes would be removed. The present research suggests the use of biogas method as the optimal disposal and for the reduction of microbial load of temporary storage [9].
In Iran and in Khuzestan there is not a true control over the cattle farms in terms of livestock wastes management and unfortunately there is no special procedure in most cattle farms for collecting the produced wastes and no place is considered for maintaining the produced wastes and they are piled outdoor on the ground and are available to the staff and public and also the vermin. No treatment operation is done on the wastes and after they are piled outdoor on the ground they will be used after in the agricultural lands and even for growing hay for the cattle without any processing. Therefore it is necessary to carry out a comprehensive research on microbial and chemical properties and the rate of wastes production, collection , storage , transportation , and disposal in all the cattle farms throughout country, so that the optimal method of treatment and disposal could adopted with regard to the qualitative and quantitative characteristics of produced wastes. In Iran no research with similar objectives of the present research has been conducted yet.

Research Method

In this study, field sampling, laboratory sampling, and library studies have been used. Traditional library studies (books, articles, theses, and projects), electronic library (internet) and valid academic and research websites have been used to gain more information about the research topic and other similar studies in Iran and around the world and also the organizations associated with the research. In this research 4 cattle farms with 20, 15, 10, and 16 heads of cattle in livestock town of Hamidieh and 27-head cattle farm of Jassempoor in Susangerd were selected as the sample. Sampling was done in the winter and spring. In order to determine the amount of produced waste per each head of cattle in each cattle farm the cattle were first weighed by a 500-kg scale and 10 cattle with different weights and similar species (Holstein dairy cattle) were selected. The cattle were fixed during the 6 months. In order to examine the rate of produced wastes per day by the studied cattle , the produced wastes during 24 hours were collected and weighed by 50-kg scale. 40 sampling was done during the 6 months. In order to do qualitative and bacterial experiments 30-gram samples of livestock wastes were prepared and 40 samples were prepared during the 6 months. The experiments were carried out according to the method of standard books. For qualitative and microbial experiment, special glass containers with lid were used which had been sterilized about 2-3 hours in the oven at the temperature of 180° C. The fresh wastes sampling was done using a sampling drill and the sample size for each experiment was 30 g and after sampling the container was placed in sealed foil full of ice and was carried to the laboratory. In order to analyze the data spss software and in order to prove the hypotheses the T-test and non-parametric analysis of sign test
(T-Sign) were used.

Results

Investigating microbial characteristics of produced wastes of the studied index (fecal coliform based on MPN/g per dry weight)

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In order to examine the microbial characteristics and the rate of fecal coliform of produced wastes special glass containers with lid were used which had been sterilized about 2-3 hours in the oven at the temperature of 180° C. Then the samples were taken from the fresh wastes of several cattle using the sampling drill and finally the container was placed in icebox and was carried to the laboratory. Waste microbial load of fecal coliform and pathogens were investigated. The results are displayed in Tables (1) and (2).

Table (1): The mean of waste microbial load of fecal coliform based on MPN/g per dry weight

Index	Unit	Mean
Fecal coliform	MPN/g per dry weight	26 x 10^9

Table (2): investigating intestinal pathogens in livestock wastes causing diseases in human

Pathogen	Type of pathogen	Disease
Escherichia Coli	bacteria	Diarrhea
Shigella	bacteria	Bacterial diarrhea
Salmonella	bacteria	Typhoid fever
Ascaris	worm	Ascariasis
Tina Saginata	worm	Bovine tapeworm
Trichuris	worm	Ring worm
Balantidium Col,	Protozoa	Diarrhea - Peptic ulcers

Investigating chemical characteristics of produced wastes in studied dairy cattle farms:

In order to take the samples of cattle wastes glass containers with lid were used. Then the samples were taken from the fresh wastes of several cattle using a sampling drill and the container was placed in the icebox and was carried to the laboratory. The results are displayed in Table (3).

Table (3): Chemical characteristics of produced wastes

Parameter	Unit	%
Total nitrogen	Dry weight percentage	1.93
Total phosphorus	Dry weight percentage	0.25
Potassium	Dry weight percentage	0.34
Calcium	Dry weight percentage	1.65
Organic matters	Total solids percentage	14.3
pH	-	8.2
Organic carbon	Dry weight percentage	13.7
Manganese	Mg/kg	106.50
Iron	Mg/kg	300
Zinc	Mg/kg	85
BOD	Mg/kg	7400
C/N Ratio	10.1	13.1

Total daily produced wastes based on kg per day in 4 dairy cattle farms in livestock towns of Hamidieh and Susangerd:

In this stage, first the number of cattle in each weight was counted, and then the total produced wastes based on kg per day were calculated with regard to the mean of produced wastes per each head of cattle in different weights. According to the conducted study, the mean of total daily produced wastes was calculated in 4 dairy cattle farms with 20, 15, 10, and 16 heads of cattle in the livestock towns of Hamidieh and Susangerd. The results are displayed in Tables (4) and (5).

Table (4): Total daily produced wastes based on kg per day in Susangerd dairy cattle farm

Cattle weigh (kg)	Cattle weight (kg)	Mean of produced wastes Per each head of cattle (kg per day)	Total produced waste (kg per day)	Mean of total produced wastes (kg per day)
240	2	12.9	25.8	466.3
290	5	15.7	78.5	
314	10	16.9	169	
350	5	18.9	94.5	
365	5	19.7	98.5	

Table (5): Total daily produced wastes based on kg per day in 4 dairy cattle farms in industrial town of Hamidieh

Cattle weight (kg)	Cattle weight (kg)	Mean of produced wastes Per each head of cattle (kg per day)	Total produced waste (kg per day)	Mean of total produced wastes (kg per day
240	10	12.9	193.5	973.6
290	15	15.7	235.5	
314	14	16.9	236.6	
350	9	18.9	170.1	
365	7	19.7	137.9	

Conclusion and Suggestions

According to the results of Table (3), livestock wastes contain considerable amounts of nutrients such as nitrogen, phosphorus, organic matters, and heavy metals which might pollute surface and groundwater in case of wastes mismanagement. Moreover, fecal coliform mean was measured as 26 x 10^9 MPN/g per dry weight which indicates high microbial load of wastes and such wastes contain microbial and pathogenic elements. Pathogens such as Escherichia Coli , Salmonella , Shigella , Ascaris , Balantidium Coli , Tina Saginata were identified some of which are transmitted to humans or to animals and then to humans and endanger humans' health. According to Tables (4) and (5) the rate of daily produced wastes in dairy cattle farms indicate that livestock fecal waste is based on its weight and both dairy cattle farms are dealing with high volumes of wastes every day which require true management and optimal decision and quick processing of manure for the waste disposal to prevent environmental and health problems and also to compensate for the costs of wastes management. One of the ways of fast processing is to dry manure by dryer because the dry manure has less pollution than the fresh manure and the pathogens are destroyed by the heat. With regard to considerable amount of produced wastes and bacteria characteristics, scraper system and tractors equipped with blades are suggested for collecting the waste without hands (Figures 1, 2). Moreover, with regard to torrential rains in the studied region and possible spread of the waste leachate into surface and groundwater and the risk of methane accumulation, their microbiologic characteristics and accumulation of pathogens such as flies, mosquitoes, vermin and the risk to the workers and local people health, covered silos with concrete floor and good ventilation system and equipped with wastewater collection system separate from the rural sewage network is proposed for temporary storage of the wastes. With regard to the climatic conditions and high level of groundwater and access to surface water and the soil type of the studied region which is mainly coarse sand, biogas method and drying the manure and compost indoors are suggested for the waste disposal. However, the suggested method for optimal disposal of the wastes in the studied areas is the biogas method because in addition to generating energy in biogas method, a type of manure with high fertilizing

value is produced. This is due to the fact that the manure produced by biogas method has high level of ammonium ion while the compost contains high level of nitrate Thus, plants absorb nitrogen better in the form of ammonium ion (NH_4+) as the nutrient which is free from many parasite eggs, parasites, and the weed seeds and can be used in hay farms which provide the cattle food in these areas. Moreover, the environmental pollution resulted from livestock wastes is controlled and reduced in this way and with regard to producing energy and selling the manure as agricultural fertilizer the costs of transportation and collection and processing of the wastes will be compensated for.

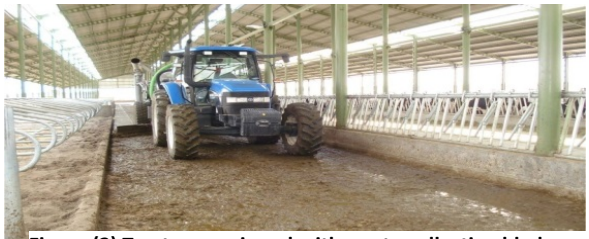

Figure (2) Tractors equipped with waste collecting blades

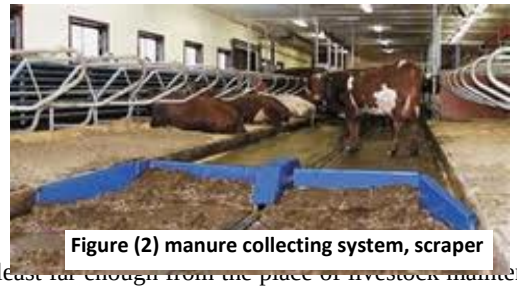

Figure (2) manure collecting system, scraper

Practical suggestions in association with true livestock waste management:

- For proper management of the livestock wastes fist of all it is necessary that dairy cattle farms be centered in one place (Ranch Industrial Park) and in order to get a permit from the Ministry of Agriculture and livestock organization they should be required to submit a management plan for the treatment and disposal of wastes and wastewater produced by livestock activities.

- Professional management committee should be formed in ranch industrial park as the subgroup of Health and Control Committee –environmental health expert to ensure the high quality of waste management and to take especial measures for setting management system and determining various tasks , evaluating and monitoring the management, and developing training programs.

- Before starting new livestock projects there should be more emphasis on animal waste management.

- All the staff particularly those working in service section should be aware of potential risk of waste mismanagement.
Training for correct collection and transfer of waste to temporary storage is of special importance and priority in such centers.
-Equipping wastewater network separate from rural wastewater network for the treatment of the wastewater produced by livestock activities in order to control health and
environmental pollution and reduce the adverse effects and problems of livestock wastes.

- Constructing special covered tanks for temporary storage of the wastes outside the dairy cattle farm or at least far enough from the place of livestock maintenance by observing hygienic and engineering rules.

- Continuous control and visit of different stages of livestock waste management operations including collection, transportation, storage, treatment, and final disposal by the authorities (Deputy of Health and Agricultural Engineering and Natural resources Organization)

- Establishing procedures for the participation of ranchers and private sector in livestock waste management

- Offering appropriate models for training and improving the staff and officials' awareness and information

- According to the regulations of livestock organization, livestock centers are required to treat the livestock wastes resulted from their activities in the production site and make them safe.

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Advantages, Disadvantages, Obstacles and Strategies for Renewable Energy

Saeed, korouki.

***Abstract*—**What we have seen so far of renewable energy, It was that, they are superior benefits than disadvantages .But the more interesting point Declining trend of The amount of renewable energy. In addition to the deleterious effects of this type of energy is rising we have more than ever to research on renewable energy gets. Renewable energy is derived from natural sources that are immortal as it has great advantages such as environmentally friendly and free. Has the disadvantage that requires investigation. After reviewing the advantages and disadvantages which represents a significant benefit .In this matter we realized that due to the superiority Obstacles affecting the development and evolution of renewable energy is which sometimes results in an uptrend or even stop the progress. Some of these factors have a greater impact Due to the high cost of setting up and installing energy absorption and others that are not reliable due to frequent fluctuations in the amount of energy available.

***Keywords*—**Advantages and disadvantages, obstacles and strategies , renewable energy.

INTRODUCTION

In recent years People around the world are facing With a major problem that Called energy crisis , Due to increasing population and Followed by Increasing energy consumption Given that traditional sources of energy in the world is very limited And energy consumption is growing rapidly. It is expected that if existing resources are used in the same manner, It is expected that if existing resources are used in the same manner, Petroleum Energy is only about 40 years and gas energy in the world is up to 100 years Will provide The growing needs of human societies. [1]therefore it can be said the world of today needs to have a huge resource, stronger, with fewer disadvantages than before feels. Energy is defined as the ability to work, it will Reveals Urgent need of the world to the available energy. Energy is the basic need to create any progress. now that the industrial world today does not stop ,The importance of having a reliable energy, permanent, affordable and accessible to more visible. demonstrated that renewable energy can be replaced with nonrenewable energy While has not the non repairable disadvantages of nonrenewable energy sources are and health and the environment is much less threatening. Forecasts suggest that by 2030, energy consumption increased 46 percent. the design of world is that it does not increase the use of nonrenewable energy and the rate of increase in demand will provided Through efficiency and use of renewable energy. the reason for this is because if the current situation continues, the earth's temperature will rise 5 degrees And a lot more damage will follow. Therefore in this context should not increase the amount of oil and gas , on the contrary , renewable energy used ,in this case the Earth is heated two degrees until 2030. [1] Iran has Proper place among the nations of the world. energy supply in Iran with conditions such as: geographic scope, social issues, different physical conditions, such as variations in elevation, climate, sea, rivers and etc requires careful planning and scientific.

BENEFITS

Benefits of renewable energy with its small disadvantages would be comparable With his bitter rival (nonrenewable energies).to better understand the benefits of renewable energy must first be paid to the advantages and disadvantages nonrenewable energy and renewable energy will be examined.

Advantages of nonrenewable fuels

1- This energy is available,
2- It can be easily designed to transportation provided.
3- These energies are cheap.

Problems in the use of nonrenewable fuels

1- The use of nonrenewable fuels annually several tons of toxic gases, sulfur dioxide, nitrogen dioxide and carbon monoxide released into the atmosphere.
2- Gas carbon dioxide from the burning of all types of nonrenewable fuels (including natural gas is the cleanest form of nonrenewable fuels) is produced, non-toxic gas in the atmosphere, the greenhouse effect and the disturbing global warming has been caused.
3- Associated gas produced from nonrenewable fuels, is causing acid rain. Acid rain is rain that has been dissolved in acid gases. Destruction of forests, pollute water and destroy important buildings, including the loss of this phenomenon.
4- Efficiency power nonrenewable fuel is low.

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Maybe not that bad when you consider the renewable and nonrenewable some of the advantages and disadvantages of nuclear energy to be examining, which is considered the most important issues in today's world.

Benefits of Nuclear Energy

1- A small amount of nuclear fuel can be released a lot of energy.(The releasing energy of burning a kilogram of nuclear fuel is equivalent by 3,000 kg coal.)
2-nuclear fuel, do not produce polluting gases.

Disadvantages of Nuclear Energy

1- Design, manufacturing, installation and operation of a nuclear power plant requires advanced technology and very costly.
2- Fissile elements, are limited and exhaustible.
3- Core fissile atoms, radioactive and dangerous.
4- The atomic fission waste, radioactive and dangerous.
5- Cost or keep the safety of the reactor facility is huge.

Limited of nonrenewable fuels and the shock of rising oil prices in 1970 due to the use of natural energy(renewable) respectively. now be review the benefits of renewable energy towards nonrenewable energy.

The advantages of renewable energy sources:

1- Fuel used in some of the equipment that provides advantage of this renewable resource completely natural and readily available in nature, and no need for exploration and mining. This is an advantage and reduce the cost of raw material ,or in some cases eliminated.
2- Using this type of energy in comparison to the overall cost is less expensive than nonrenewable forms of energy (But more money is needed for the initial setup, which may be due to lack of popularity).
3- In comparison with traditional power generators require less maintenance.
4- Use this type of material, waste does not exist.
5- In the field of investment income and large profits for the investors has to burp, especially in the Middle East.
6- Because of being a new topic and possible advances and having the market and a huge demand could create many job opportunities.
7- Use them in almost all cases has no impact on global warming and does not harm the environment.
8- Literally, does not produce any greenhouse gases or pollutants.
9- Helps to the economy of any country because of its energy resources, not all of it but most of them are found in all countries.
10- You will pay a much lower electricity bills!
11- Cost of production and operation of our energy needs in this way will be less.

Environmental benefits:

1- Does not produce polluting gases and harmful to the atmosphere.
2- Residues that are not problematic.
3- These energies are inexhaustible while the finite and nonrenewable energy sources are limited.

Strategic advantages:

1- local and regional renewable energy can be produced.
2- Renewable energy thereby Independence

Social and Economic Benefits:

1- Renewable energy enhanced Small communities because often the equipment will be installed in rural areas.
2- Energy creates opportunities to a nation to develop national technology. [2]

Now will Explained the benefits of renewable energy as an energy source

1- Reliable electrical power can be Produce by stable prices
2- Can be helped to electricity suppliers to diversifying the resources required for the production of electricity
3- The production of electricity with minimum environmental pollution
4- Assist countries to achieve development goals of using renewable energy
5- Creating opportunities for economic development especially in rural and remote underdeveloped areas [3]

Renewability

renewable energy sources have a long life and cycles are normal, And even in the end of this resource does not exist, Unlike nonrenewable energy sources such as nonrenewable fuels that are facing with danger of end. [4]

High capacity in Energy Production

Renewable energy sources have a high ability to produce energy. Especially resources such as wind, sun and water (waves) because of the numerous and geographically convenient facilities can produce a lot of energy into electricity and this in addition to great savings in the consumption of non-renewable fuels has an important role in reducing pollution.

Decentralized energy production centers

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Unique use of powerhouse with nonrenewable fuels can be Create energy that will be concentrated in areas, while using renewable energy sources can easily fit in any geographic location Used to produce energy And this has been decentralized energy production centers And are even used as villages and islands scattered areas with low population. [5]

Lack of environmental pollution

Unlike nonrenewable fuels, renewable energy sources are characterized by the absence of emission of pollutants, including air, water and soil
It provides desire to use these resources especially due to the reduction of emissions of greenhouse gases have been.In Table 1 we can see the impact of renewable and nonrenewable energy sources on air pollution.

Impact on air pollution	Renewable energy sources				Non renewable energy sources		
	Wind Energy	Solar Energy	Geothermal Energy	Biomass Energy	Coal	Crude oil	Natural Gar
	Close to zero	Close to zero	Close to zero	Low to moderate	Very much	Medium to high	Low to high

Table1:Compare the effectiveness of different types of energy sources on air pollution

PROBLEMS OF RENEWABLE ENERGY SOURCES

Everything has advantages and disadvantages. And use of these resources is not Apart from this principle. So some of them are as follows:

1- Some of them depend entirely on the weather conditions and if the conditions were favorable, Produce acceptable and expected returns. For example, hydroelectric generators requires adequate rainfall to the extent that the dam is filled to a certain size wind turbines require wind intensity are suitable. that demanding particular environmental conditions, regional climate.
2- Providing the energy of a country or even in large cities is very difficult with this method.
3- The cost of procurement of equipment and products for renewable energies can sometimes be very expensive, so a normal person cannot afford it.
4- Compared to non-renewable fuel generators, renewable energy requires a lot of time to produce electricity in large quantities.
5- May be there have not sufficient resources for the conversion of renewable energy.
6- Use of this energy needs to reduce energy consumption in the world.
7- Sometimes literally installation costs can be very high.
8- They are inconsistent and unpredictable.
9- They are unreliable energy supply. [6]

Limitations of time and space

The costs for investment in this source of energy is very high, although maintenance costs are low but because of the initial investment cost, the use of these energy sources is more expensive than other energy sources.

constraints of Time and space

These resources can not be used at all times and places for example, wind energy, the turbines must be installed in a location with sufficient wind speed and constant throughout the year. So that a minimum wind speed should suffice In the area of energy to propel the blade. Or in the case of solar energy, In areas with high solar heat and light from the sun permanently installed .Of course seasons change and time also provides Disorder on the activity of the sources of energy production centers.

Energy Source	Place limits	Time limit	Efficiency	Cost
Wind Energy	Yes	Yes	Average	Inexpensive to moderate
Solar Energy	Yes	Yes	Low to moderate	Medium to high
Geothermal Energy	Yes	Little	Average	Inexpensive to moderate
Biomass Energy	Little	No	Medium to high	Average

Table2:The overall comparison between different types of renewable energy sources [6]

OBSTACLES

Major Obstacles and macro management of energy consumption can be briefly outlined as follows:

• Lack of convergence and Interference of the various organizations in decision-making for Iran's energy management.
• Non-compliance with approvals Committee on Energy consumption criteria Under the law of footnote of Islamic consultative Assembly budget in various socio-economic sectors
• The need for investment needed to modernize and restructure the energy systems Iran
• Lack of public awareness of the benefit of law enforcement and legislation to reduce energy consumption
• Low efficiency of processes in energy systems
• the nozzle prices for energy carriers

In addition to general items listed, over the past 10 years, certain problems have also emerged in Iran sustainable

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projects that its development has been slow, including the most important ones can be listed as follows:

Lack of national and local laws:

To encourage the development of renewable energy technologies and markets, national and local development policies in the field of potential survey and identify resources,construction, installation and operation of renewable energy is essential. To development of use of renewable energies for electricity generation and thermal applications for heating, policy and legislation for planning, management and implementation of renewable projects is essential. application development of renewable energies in Iran began with the establishment of the Renewable Energy Organization of Iran in 1995.before it renewable Energy activities were carried out in a number of organizations and are distributed and did not follow any particular policy, short term or long term. By changing the nature of the Renewable Energy Organization of Iran As a wholly state-owned company under the Ministry of Energy It was agreed that all renewables activities be done by the new energies. perhaps it was the first law that was enacted to promote the use of Renewable Energy in the country. After the law was passed all activities of Renewable energy, including planning, management, budgeting, and human resources professionals from other organizations and ministries were transferred to the Renewable Energy Organization of Iran ,but for now apart from the Guaranteed purchase of electricity from renewable sources there is no legal support and guidance for the development of new energy application. In most countries in the world In addition to tariffs the price of renewable energy there are a lot of law in Support and encouragement about renewable projects in various stages of implementation , to exploit the potential survey. It is essential Renewable Energy Organization of Iran as custodian of this country's energy sector apply to the local and national laws about property rights and the exploitation of resources, the operational principles of sustainable development and the development of technical knowledge.[3]

Technology

many renewable energy technologies are expensive and relatively complex and compared with traditional energy supply, require higher capital costs for the supply of energy dense urban areas or major industries, in addition, Service delivery, operation and maintenance of renewable energy equipment is not easy. broad limits of the sanction should be added to these obstacles.

Policy and administrative mechanisms

Use of renewable energy technology requires significant initial investment before reaching the stage of profitability, should be supported for a long period. establish a mechanism to encourage and support the use and development of renewable energy and create a body of expertise to ease regulation on renewable energy activities are not allowed. Also consumers about the benefits and opportunities of renewable energy are not aware.

Financial Economics

Economic and social system of energy services in the iran is focused on the development of traditional energy sources, particularly electricity generation, gas and liquid fuel supply. moreover, the price of energy from renewable resources is still high. on the other hand, there are still serious obstacles in the way of open access and non-discrimination of key energy infrastructure For example, national network and liquid and gaseous fuels infrastructure. at present, even though the cost of new energy is higher than any other energy, but some countries on the path toward use of energy, But some countries(on path to the application of energy) are making equipment and technologies that are able to minimize the cost of new and renewable energy.[7]

GUIDELINES

Roadmap for the development of renewable energy in a three-step approach should be considered.in the short term, the stimulus policy should be adopted to attract investors to the relatively new field of business, overcome Obstacles that impede the implementation of projects and projects move towards commercial exploitation. when the domestic capacity growth was acceptable, in the long term, political space should be moved towards improving the competitiveness and deregulation of the market, with a substantial increase in the scale of activities.the use of public and specific incentives for producers of electricity from renewable energy ,accelerate the development of renewable energy including public stimulus can be noted to guarantee the purchase of electricity generated by manufacturers by forcing distribution companies to buy all the electricity supplied by them. Power purchase tariff with regard to cost of new transmission lines to connect to the network and allow renewable energy producers to enter into bilateral contracts or direct sales to final consumers. [8]

Some other renewable energy strategy is as follows:

• Create a centralized management system for the country's energy sector
• reform of the pricing system energy carriers
• observe criteria adopted by the consumption of energy carriers in different socio-economic sectors
• Replace old and worn out equipment and facilities in different parts of the energy consumption
• Optimizing energy consumption in the entire system
• Reduce energy intensity in units and systems
• observe regulatory approvals and regulations on energy use by state authorities

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• National Training and Information
• develop a comprehensive energy plan for the country
• modify consumption patterns

So it should be stated if the macro strategies in the energy sector will lead to administrative actions and obstacles on the way to be removed, modified eating pattern, optimization, and energy management system.

RESULTS

However, according to the present brief reports and before a comprehensive review of the components listed should not come to a general conclusion but the evidence suggests there are numerous benefits to using renewable energy that's according to Iran's economic and political conditions, are negligible. increased consumption of energy and other nonrenewable energy harmful effects are not negligible. renewable energy obstacles that have a significant impact on their progress can easily be solved with a little attention and in a period of several years and it is better That before the urgent need and achieve critical condition track consumption and production of energy reached to the reliable and low loss way.

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Synthesis based researches (Integrative Inquiry) of environmental education in terms of attention to the integrated and interdisciplinary curriculum

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Abstract
This study aimed to assess the environmental education research in terms of attention to the integrated and interdisciplinary curriculums. This study is descriptive and uses synthesis method (integrated research) and regulated by a non-systematic review that performed through databases and search resources such as Scopus, Doaj, Eric, Scholar Google, Google and local sites such as SID, Noormag, Magiran, Irandoc, portal of human science and also library resources with combined keywords as "Environmental Literacy", "Environmental Curriculum", "conservation Curriculum", "Environmental Education". Findings showed that the majority of Iranian researches of environmental education had few attention on presenting framework, models and appropriate procedures to the practical and theoretical studies, and they just confined the descriptive, theoretical and content analysis of these domains in the content of the textbooks .

Keywords: Integrative Inquiry, curriculum, integrated curriculum, environmental education

Introduction

According to researchers, the lack of environmental awareness is the most critical factor leads to environmental degradation (Vaktola1, 2009, 4). Education is the most effective tool for dealing with future challenges of environmental issues (MirDamadi et al, 2008). Environmental education is emerged in response to crisis and aimed to train a responsible and active citizenship who equipped with the knowledge and will in the field of environment (Daskolya and AJlido, 2006, 126). The purpose of this green approach is to help learners to make sense of natural world and interact with the world around them. Trained citizens are aware of the environmental issues and know how to solve it and also have motivation for implementing guidelines(Alvarez and Wega Maroot, 2010; Criddle 5, 2010). In Agenda 21 and the Rio + 20 conference the emphasize was on environmental education(Agenda 21, 1998). Multiple literacy's are included while the amplitude of the "literacy in the new millennium" has gone beyond the traditional level. UNESCO defines the new literacy's along with ethical literacy, health literacy, computer literacy, financial literacy, media literacy, information and technology literacy. Among them the most critical and the most important are ecological literacy, changing values and attitudes toward ecological literacy, participation in protecting the environment, engaged and responsible citizens, training correct using of resources, lifestyle consistent with the nature, accurate decision making for solving environmental problems and prevent rising of new problems, having sensitivity to various events and decisions that affect the environment, achieving the power to detect and analyze new methods to solve the problems of environment, (Lansdel and Mc cary , 2004).

In an overall classification curriculum approaches is divided into three categories: scientific-technical, nonscientific-nontechnical and middle patterns. The middle patterns are models that range between technical and non-technical patterns, and in some aspects it has the peculiarities of both models listed above(Yarmohammadian, 2002).Within a multidisciplinary and interdisciplinary approach as part of the third model, a concept, theme, content, skill or process becomes as base of curriculum which uses fields and different materials to explain it and also is organizing by combining science fields. This method provides the possibility to analyze new problems and give a broad view to learner and decreases dogmatism

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(Yarmohammadian, 2000). Environmental issues due to be surrounding has the capability of offering in this category. Issues related to the environment naturally are holistic and bring different approaches in various fields and due to the special nature as it has, you can set it at educational interdisciplinary and flexible approaches (Soleyman Pour omran, et al, 2012).Available approaches in the field of environmental education are complex and refers to resources, time, space, curriculum, learner's characteristics and a wide range of factors that can affect any type of functional training (Vinser et al, 2010). Also addressing the environment through interdisciplinary method makes it to be seen beyond the time and space. Undoubtedly using the capacity and scientific findings and other educational experiences from various fields can establish a more comprehensive understanding of it. Hence, traditional programs and instructional methods are not capable of responding to today's environmental needs, so the training should be done by integrated methods and interdisciplinary (Soleiman Pour omran, et al, 2013). Nonetheless in most environmental education researches, presenting appropriate approaches and models for environmental education and also practical and scientific frameworks for training seems to be neglected. Present study seeks to evaluate a set of environmental education research in the case of environment.

Methods

This study is a descriptive and non-systematic review. Its materials achieved through searching in databases such as Scopus, Doaj, Eric, Scholar Google, Google and local sites such as SID, Noormag, Magiran, Irandoc, Portal of human science and also library resources. Searching through internet performed by keywords such as "environmental education", "environmental literacy" "environmental curriculum" on 2012 and first half of 2013.The English keywords were "environmental education", "environmental curriculum ", "environmental literacy"and"curriculum", and a large number of domestic and foreign articles were found. Then taking notes from theoretical basis and reviewed literatures were used as means of data collection. Statistical universe included all articles and scientific resources, previous researches, scientific databases and resources for environmental education and environmental literacy. Sampling method is purposive and the resources are the ones that researcher is able to achieve them. Since the scope of this issue is extensive, a preliminary classification of the subject performed and the resources found were placed in these categories, then examination and initial review of its titles and abstracts were performed. Finally the articles which were the combination of English words (environmental education, environmental curriculum, and environmental literacy) reviewed and evaluated using synthesis research (integrated research). Combination refers to the process by which certain elements are placed next to each other or stick together as a whole. This is much more than merely juxtaposing a bunch of information and cause the rising of new perspectives and relationships. This process involves the followings:

1. Feel the need,
2. Combine existing knowledge with these needs
3. The practical transfer of knowledge to the targeted audience's needs

Based on J,Marsh categories , this research is performed based on second category of integrated research which studies a particular topic and organize them in a way that can be compared with the studies(C. shorts, 1991, 354-350).

Research findings

From theoretical resources and research literature it can be concluded that:

1. Environmental education with sustainable development goals are interconnectedclosely. Moharamnejad and Heidari (2006), Haj Husseini et al (2010),Karimi and enayati (2012), Department of Environment in Australia (2000).

2. Environmental education asa part of citizenship education and globalization in curriculum of Iran's formal education system and other Asian countries havebeen ignored till today. Badkouyi (2000), Diba (2009), Adib (2009), Farmeyhany Farahani (2005),Fathi al (2005), Salehi et al (2009).

3. The formal curriculum plays a basic role in environmental education. Mahmoudi and Veisi (2005), Moharamnejad and Heideri (2006), Shobeiri et al (2006).

4. Secondary school is the appropriate opportunity to develop high levels of knowledge, skills and values ofenvironmentsin educational systems. MirDamadi et al (2008), Salehi et al (2009), Rafiee and Amirnejad (2009), Haj Hosseini and colleagues (2010), Mirdamadi et al (2008), Haj Husseini et al(2010).

5.In order to gain an environmental literacy,the curriculum should be performed around three axes of knowledge, skills and attitude.Framehany Farahani (2005), Fathi et al(2005), Shobeiri et al (2006), Salehi and Agha-

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Mohammadi (2008), Kahlamir (1999) (UNESCO, 2000, 3),Australian department of environment (2000).

6. Environmental education doesn't have the capability to change the student's attitudes and studentsdon't have the skills to use it and also it has not benefit for the students. Ferdowsi and colleagues (2007), Haj-Hosseini, et al (2010), Dibaee and Lahyijanyan (2009), Kahlamir (1999), Eini Matt et al (2007).

7-Traditionalmethodssuch as there abilitationof memory have been used-In environmental education and as well asthe needs,experiences, attitudes and interestsofstudentsnot included and it needs a fundamental revision.Yaghoobi (2003),Diba (2003), Turaniand keram o Dinni (2004), Dibaee and Lahijanyan (2009), Haj Husseini et al (2010).

8. Awareness of the environment, respecting the rights of others, critical thinking skills, abilities and skills in collaboration with others, having an interest in the environment,… and gaining skills such as self-awareness, decision making, human relations, critical thinking , responsibility and participation are factors that must be considered in environmental literacy. Diba (2003), Adib (2003), Farmeyh anny Farahani (2005), Fathi al (2005), Soltani, et al(2011), Alfoohy et al (2011).

9. Environmentaleducation scattered in the books of different grades is not consistent and it's not based on a specific framework and program. Turani and keram o dini(2004) ,Ghazavi et al (2010), Ghazavi et al (2008) , Salehi et al (2009).

10. Students who learned environmental education showed more protective behavior. Ferdowsi and colleagues (2007), Ferdowsi, et al (2007), Rafee and Amirnejad (2009).

11. Separated programs and traditional education methods are unable to meet today's growing needs of environment and it just provides a superficial level for environmental knowledge. Eyni, M. (2008), Dibaee and Lahijanyan (2009), Shobeiri and colleagues (2002), Seyed Abdullah al (2011), Agaz et al(2010).

12. Environmental integrated education shows further progress in the field of environmental knowledge and attitudes for the students. Environmental education can be offer in the school curriculum through interdisciplinary courses within traditional subjects.Jekayenfa and Yuseph(2005), Forbes and Smith (2000), Gerik (2011), Prion and Prasart (2011), Little Deek (2008), Seyed Abdullah al (2011).

13. Studentsare ready to accept facts and knowledge, environmental attitudes and new approaches and are keen to play a role in this context and require specialized and practical information for dealing with their environment. Veisi et al (2012), Abdullahi and Sadeghi (2012), Shobeiri and colleagues (2010), Haj Husseini et al (2010), Cheristenson (2008).

14. Study of environmental books, parental education level, gender, class and school management (public and private) are the factors that could influence students' interest and knowledge about the environment positively. Bagheri (2003), Shobeiri et al (2006), Veisi et al (2012),Youito et al (2011).

15. All components of ecological literacy is not addressed to an extent. Most attention to environmental issues was in the curriculum and especially textbooks at the lowest level of knowledge and there was minimum attention to skills, and attitudes regarding the environment.
Eyni M. (2008), Yaghoobi (2003) and Salehi Agha-Mohammadi (2008), Bayat et al (2013), Taghie and colleagues (2012), Erdogan et al (2007), Eserbinoskia (2010), Dibayee and Lahijanyan (2009).

16.In environmental education by textbooks, the share allocated to the text have been greater than images and questions. Eyni, M. (2008), Mashallahi Nezhad (2011).

In general, most domestic research in the field of environmental education have addressed content analysis and comparison of three domains of cognitive domains, values and skills in the content of textbooks. Lack of research in the field of environmental literacy and environmental integrated curriculum felt clearly. These conducted researches can be grouped in three general categories:

1. The first category are studies in the field of environmental curriculum and literacy that analyzed only content or evaluate the requirements. These studies didn't mention problems of curriculum designing and organizing content of such education or they had thematic view instead of an integrated vision. This group encompasses a large part of the internal investigation. Eyni

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M (2008),Mashallahnezhad(2011), Afkhami and Maleki (1999), Hakim zadeh et al (2007), Ghazavi, Liaqatdar and Abedi (2008),Dibaee and Lahijanyan (2009), Salehi et al (2009), Ghazavi et al(2010), Saleh, et al. (2010), Taghieet al (2012), Bayat and colleagues (2013), Erdogan et al (2007), Abdullahi and Sadeghi(2012), Veisi et al (2012), Shobeiri and colleagues (2010), Haj Husseini et al (2010), Fathi and colleagues (2005), Esrebinoskia (2010), Agoraamb et al (2009).

2. The second group in the field of environment just mentioned integrated curriculum and they didn't present any model or framework. Greek (2011), Jekayenfa and Yousef (2005), Seyed Abdullah al (2011), prion and Perasart (2011), Little Deek (2008).

3. The third category have been mentioned integrated approach and attempted to present a theoretical model and framework practically. The education of Israel 1984, Palmer et al (1998), Fortieretal (1998), Forbes and Smith (2000), Australian department of environment (2000).

conclusions

So, environmental issues are such a soft science with integration ability to be interdisciplinary. Integrated education issues would add to the richness of the curriculum because it makes the learning better, significant and effective, and makes special capabilities, capacities and qualities for the students and increase realization and thinking skills, multiple intelligence, naturalistic intelligence, aesthetics and learning in real life situations. It will also affect the cognitive aspects and problem solving, training and learning of core concepts in which integration takes place and cause permanent and better training of those issues.

Therefore, all the researches show that in most environmental education research, providing appropriate and practical framework for environmental education and appropriate approaches and models for environmental education has been neglected. This is particularly highlighted in environmental education researches of Iran that these researches approaches are mostly limited to theoretical and descriptive studies and content analysis. They are just comparing three domains of cognition, value and skill in the context of textbooks and they are not intended to provide a model or theory of expansion and strengthening of environmental literacy or methods and practical teaching strategies, organizing content, experiences of teaching- learning and evaluation, etc.

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The Equity Assessment and Evaluation on the Health of the Families of Tehran and the Workers

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Abstract-An important social category that is always affected by the process of the economic development and income inequality is the situation of the health of the people. This is why some countries establish different research organizations to assess the health conditions. In Tehran, along with its other health projects, the Health Office of the Social and Cultural Deputy of the Tehran Municipality conducted the urban health equity assessment (known as the Urban HEART).
This research aims to compare the workers that are covered by the Iranian Social Security Organization (SSO) with the total sample of Tehran City using the Goals Achievement Matrix and SPSS software. This comparison will be done in three fields including the physical and infrastructural environment, economic environment, and the human and social development environment. The results show that the health level of the sample workers is higher than the sample of the Tehran City. This piece of result is true for the "poorest" and "richest" samples as well". Moreover, the results of the Goals Achievement Matrix show that the first quintile of the workers gained the highest health scores (179). These results have been adopted from the 2011 Health Assessment Project of Tehran City.
Keywords: Health, Equity, Families of Tehran, Workers.

1. INTRODUCTION

In its comprehensive concept, health encompasses many (if not all) aspects of life including the mental, sexual, spiritual, physical and social health. Thus to deal with the health requires to know all aspects that affect the health of the human and society on one hand, and the cooperation between the different parts of the society including the people, organizations, decision-makers, and the policy-makers on the other hand. Urbanism is a complicated phenomenon that affects the lives of the individual, family, society, and the countries. Indeed urbanism can be considered as the "main component of the health" in the current century. In 2007, the urban population of the world exceeded the 50% of the whole global population for the first time. In particular, the speed of the urbanism is considerably high in the developing countries; and unfortunately, in many cases the countries are not able to prepare the needed urban infrastructure for such a huge mass of population and then, the face the accumulated underdevelopment. In many regions of the world, the"unplanned urbanism" leads to several negative effects on the health of the people and society. This is while the urbanism *per se*brings some challenges for the health of the human including the water and environmental challenges (such as the water, air and noise pollutions), non-communicable diseases and their causes (such as the tobacco products, lack of exercise, unhealthy nutrition), mental and social health challenges, the epidermis of the new-emergent communicable diseases, violence, drug and

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alcohol misuses, the risks of the new lifestyles, accidents, and all above, the inequity of the health.

In this article we firs the Urban HEART project as a tool for achieving the health, and then we will investigate the effective factors on the health of the Tehran sample and the workers. These two groups will be compared using the SPSS software. Moreover we will use the Goal Achievement Matrix for conducting the mentioned comparison.

2. THEORICAL FOUNDATION

Health is a social capital. It is not only unique, but nonexclusive. On the other hand, the equity has been defined as the equality of sharing things. Some theorists define the equity as the equal access to whatever leads to the peace and welfare in the society. Aristotle believed that the equity is equal to justice and justice is moderation in all affairs. According to this definition, everyone has to gain whatever he/she deserves according to his/her rights. Based on an Islamic point of view, Imam Ali believes that the equity or justice is a divine tradition and it is the cause of the nations' stability, stability of the governments, and the main factor of the development and prosperity of the cities. In his testament, Cyrus the Great states that if the governors neglect the implementation of the equity and justice, they will lose their status and position very soon. According to the World Health Organization, in any equity-oriented health system the people with equal health needs have to be dealt equally (horizontal equity) and those who need more health requirements have to be paid more care and attention (vertical equity).

Equity of the health is one of the most important relevant issues to the health economy and policy making and it is a fundamental challenge in the area of the public health and social inequity. The most common definition of the inequity of health has been suggested by Whitehead and Dohlgren (1992): inequity of health "is the set of avoidable and unnecessary inequities that are imposed unfairly and unrightfully". But the inequity of health refers to those inequities that are unfair. Thus the inequity of health focuses on the distribution of the sources and process that leads to the inequity of health. The equity in using the health services has a moral dimension. According to the Statue of the WHO, it is a fundamental right of the people to benefit from the highest achievable level of the health. This level of achievement is based on the social agreement and the goal of the health system. The main characteristic of this health system is to develop the coverage of the health services to the whole population.

2.1 INEQUALITY OF HEALTH IN IRAN AND THE OTHER COUNTRIES

The available statistics show that the highest relative index of the health in the developed countries is better than the corresponding index in the underdevelopment countries. According to the WHO 2009 repot, in 2007 the life expectancy in Africa was equal to 52 years but in North America it has been equal to 76 years. Such an inequity is more evident between different countries. For example, the life expectancy in the same year in Japan and Italy was equal to 83 and 82 respectively, but the same index in Sera Léon and Afghanistan was equal to 42 and 41 respectively.

The available statistics show that in Iran, different provinces have different levels of the index. Such differences can be even observed in different classes of a single city. A reason of such inequity is the unfair distribution of the sources and coverage of the health services. Anyway, a glance at the history of the health indexes in recent years shows that in Iran, some indexes have been developed rapidly on one hand, but the inequity has been widening in some regions of the city on the other hand.

Urban HEART is the abbreviation for the Urban Health Equity Assessment and Response Tool. it is a user-friendly guide for local and national officials to identify health inequities and plan actions to reduce them. Using evidence from WHO's Commission on Social Determinants of Health, Urban HEART encourages policy-makers to develop a holistic approach in tackling health equity. Urban HEART was launched as a pilot plan in Japan's Kobe Institute in cooperation with the World Health organization in three cities worldwide including Tehran. This tool is the result of the cooperation between the Kobe Institute, WHO, and the local officials of the knowledge network in the urban environments. Urban HEART aimed to provide the needed evidences and data for evaluating and reacting the unfair health conditions and inequities in the urban environments for the urban managers and the officials of the health system in a systematic way, while emphasizing on the neutralizing interventions in the health conditions. At the first half of 2007, the Kobe Institute that was in charge for conducting some urban studies on the "effective socioeconomic factors on the health" formulated some indexes in four areas (including the policy making, physical environment and infrastructures, human and social development, and economy and governance) and offered them to several different countries. Tehran Municipality declared its readiness to be one of the 5 pilot sites of the "Plan for Assessing the Urban Equity Using Urban HEART". To assess the equity in Tehran, some indexes were formulated in 6 areas of Tehran city with the cooperation of all relevant authorities and officials. These indexes included the human and social development, physical and infrastructural development, economic development, health, urban governance, and cultural governance. In 2009, Islamic City Council of Tehran City considered the formulated indexes in the 5-year Urban Development of Tehran. Then in November 2010, the

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Iranian Supreme Council of Health confirmed 52 selected indexes for assessing the inequities in the country.
The second phase of the Equity Assessment of Health was conducted in 2011 and it was operationalized by the Health Offices of all 22 municipal districts of Tehran by sampling the population at the level of the neighborhoods among 1600 families in 200 blocks of each districts (the total number of the families was equal to 34700, encompassing more than 118000 citizens).
Urban Heart project of the WHO Kobe Center attempts to provide an easy pattern for the policy- and decision-makers at the local level in order to meet the two following purposes:

a. To determine the differences between the optimal life among the citizens in the rich areas and other urban areas
b. To adopt some strategies, interventions and actions for reducing the inequities among the residents of different areas of the city

2.2. URBAN HEART

2.2.1. Main components of Urban HEART

Some complicated problems such as the reduction of the health inequity and the social problems have not a single solution and prescription, but they have to consider the operational interventions. Such problems are mainly cyclic processes rather than the linear ones. They require the cooperation of all local beneficiaries and authorities. Three main elements form the implementation of the Urban HEART: 1) visual evidences, 2) inter-organizational operation for the health improvement, and 3) public participation.

2.2.2. Process of the planning and implementation of the Urban HEART

In brief, thepolicy-making process is a system – mechanisms andrules – that allows both policy formulation (what canbe done) and policy implementation (how to makeit work). The outputs of this system involve actorsfrom various groups (community, lobbies, etc.) who participate, influence, act and impact on policies.It ensures consistencywith the local governance processes, allows theintegration of the results of the assessment in thelocal political debate, facilitates linkages with othersectors, ensures better chances of influencing thebudget allocation and, most importantly, putshealth equity issues at the heart of the local policymakingprocess.

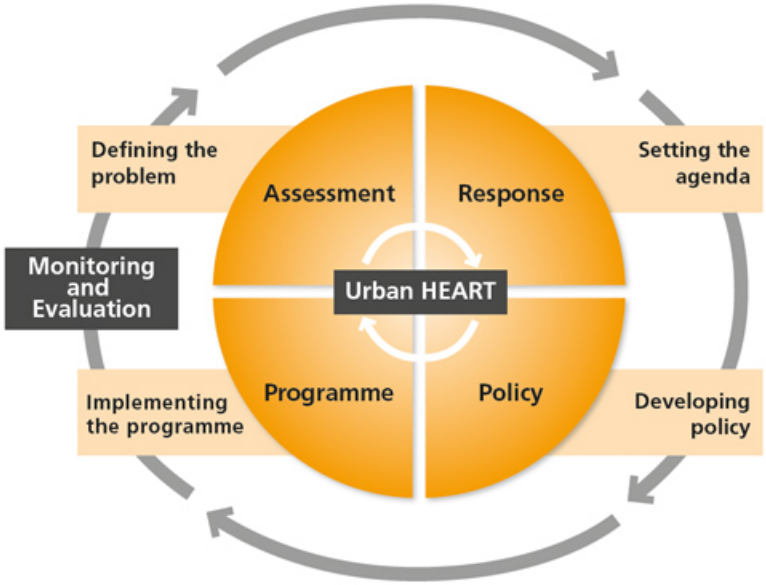

Figure 1. Urban HEART integrated into the local planning cycle

2.2.3. Organizing the indexes of URBAN HEART

The evaluation of Urban HEART elements is being done by some guiding indexes that are planned for understanding the difference between different population groups in city that are included in the effective factors on the key results of the health and social factors of the health.

2.2.4 Classification of the indexes in URBAN HEART

- Key results of the health, including the specific diseases (mortality/ consequences)
- Social factor of the health, including the physical and infrastructural environment, human and social development, economy and governance

This tool has been designed for areas beyond the scope of the health. In Urban HEART, health is a comprehensive concept and includes all areas of development. The

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purpose of the equity assessment plan is to reduce the inequities. In other words, it aims to reduce the inequities and make all people access to the urban facilities fairly and equally. Table 1 shows the scopes of the health policy making and related areas.

Table 1. Scopes of health policy making and related areas.

Scope of policy making	Areas
Scope of the social and human development	1. Literacy and education 2. Elders, children and vulnerable groups 3. Social capital 4. Disability 5. Food security and nutrition
Scope of the infrastructural and physical environment	1. Access to the public transportation 2. Environment (air and noise pollution, wastes, quality of the drinking water) 3. Traffic and home accidents
Scope of the health	1. Chronic diseases and life expectancy 2. Hazards (fatness and overweight, physical inactivity, tobaccos and drug addiction, mouth health, nutrition, physical pains) 3. Mental health, violence, quality of life
Economic scope	1. Employment (unemployment, employment of youths) 2. Family expenses, poverty (economic, educational, multidimensional) 3. Life facilities (physical properties of the family, house facilities) 4. Heavy costs of the health, fair participation in supplying the health costs, insurance coverage
Scope of the urban governance	1. Satisfaction with the urban services 2. Accountability
Cultural scope	1. Respecting the values

Source: The results of the second round of the equity assessment in Tehran, Tehran Municipality

In above cases, the areas of the food security and families' vulnerability are studied under the scope of the social and human development; the car accidents are studied in the scope of the infrastructure and physical environment, chronicle diseases, overweight, tobacco and mental health are studied under the health scope; and finally the family expenses, costs of the health and the poverty are studied under the economic scope.

A main component of any successful assessment is to form a matrix that illustrates the inequity. This matrix is indeed the organized indicators in a simple graphical format to be used by the policy-makers and the investors. Such a matrix can be applied on the following areas:

1. Comparing the performance of the cities or inter-urban neighborhoods
2. Comparing the effects of the policies and the plans

Table 2 shows the urban performance matrix in terms of the indicators that are relevant to the health factors in Tehran sample and the workers sample. The colored codes in each cell show the level of progress in the specified areas, so that the green implies "very good performance" and the red implies "very weak performance" (with regard to the situation, national and international goals, or the means), while the yellow shows the moderate performance. It is to be noted that the columns imply the scopes and indicators, while the rows imply different groups in the city.

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Table 2. equity matrix of the urban health (comparing the workers group and Tehran sample group)

	Human and social development				Physical envi.		Health										Economy							
	Food security		Vulnerability		Accidents		Hazards		Chronicle diseases				Mental health					Facilities		Poverty and the health costs					
	Lack of milk consumption	Lack of fruit consumption	Divorced people	Female-headed households	Traffic-related	Non-traffic	Overweight	Tobacco use	Diabetes	Osteoporosis	Blood pressure	Asthma	Anxiety	Social performance	Physical building	Depression	Mental health	House owner	Tenant	Average health costs	Below the poverty line	Below the poverty line (visited)	Below the poverty line (diagnosed)	Below the poverty line (health cost)	Below the poverty line (hospital)
all families																									
1st quintile																									
5th quintile																									
All workers																									
1st quintile																									
5th quintile																									

Source: Authors

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In order to assess the scale of the health, we have used several methods. The first method was to use the Goal Achievement Matrix in which the importance levels of the indicators are determined in the loading section. This determination of the importance levels include the values between 1 to 5, where 5 is equal to "very important" and 1 is equal to "not important". Then the loadings of the Tehran sample and workers sample was assessed based on each indicator. These scores included the values of 0, 1, 2 and 3 where 0 is equal to be "incompatible with the relevant indicator"; 1 is equal to "little compatibility", 2 is equal to "moderate compatibility" and 3 is equal to the "full compatibility". Then the scores of the families in the two groups (Tehran city and the workers) are specified (table 3).

Table 3. Loading the indicators

Indicators	Loading the indicator	Loading the total Tehran families in sampling	Loading the 1st quintile of Tehran families	Loading the 5th quintile of Tehran families	Loading the total workers in sampling	Loading the 1st quintile of Tehran workers	Loading the 5th quintile of Tehran workers
Lack of milk consumption	4	1	1	1	1	1	1
Lack of fruit consumption	3	3	2	3	3	3	2
Divorced people	3	3	3	3	3	3	3
Female-headed households	4	2	1	3	3	3	3
Traffic-related accidents	3	3	3	3	2	3	2
Non-traffic accidents	2	3	3	3	3	3	2
Fatness	4	2	1	2	2	2	2
Tobacco use	5	2	3	1	2	2	1
Diabetes	4	2	2	2	3	3	3
Osteoporosis	4	2	2	2	3	3	3
Blood pressure	4	3	3	3	3	3	3
Asthma	3	2	2	2	3	3	3
Anxiety	5	1	1	1	2	2	1
Depression	4	1	1	1	1	1	1
Social performance	5	2	2	2	2	2	2
Physical building	4	1	1	1	2	2	2
Mental health	5	2	2	2	3	3	3
House owner	4	2	3	1	2	1	1
Tenant	5	2	2	1	1	2	1
Average health costs	4	1	3	0	1	0	0
Below the poverty line	5	2	2	2	2	2	2
Total		159	165	145	169	179	157

Source: Authors

The results of the above table show that the score of the workers in the 1st quintile is higher than the other groups. This result indicates that the workers of the 1st quintile benefit from the health more than the others. Since the 1st quintile workers are the poorest group of the study, the mentioned results seems very interesting.

We have used the inferential and descriptive statistics to statistical analysis of the data. In this regard, we first prepared the charts and tables of the frequencies in order to capture an overall picture of the data. Then we used the inferential statistics to find the data distribution using the suitable tests for determining the relationship between the variables. In this regard we have used SPSS software that is a strong tool for the data analysis. The statistical population of the research included all residents of Tehran. The sample of the research included 34700 families (encompassing 118000 individuals). The second phase of the Equity Assessment of Health was conducted in 2011 and it was operationalized by the Health Offices of all 22 municipal districts of Tehran by sampling the population at the level of the neighborhoods among 1600 families in 200 blocks of each districts. Our data in this research has been extracted from the data of the mentioned project. Here N is the number of the individuals (table 4).

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Table 4. Scores

Indicators	Total	N Workers	N Workers of the 1st quintile	N Workers of the 5th quintile	Total sample of Tehran	N families of the 1st quintile in Tehran	N families of the 5th quintile in Tehran
Traffic-related accidents	18,862	430	191.49	612.01	1511	919	2098
Non-traffic accidents	18,862	235	179.52	460.16	1176	1072	1485
Blood pressure	8,868	72	70.03	96.92	770	673	920
Diabetes	8,868	471	381.97	511.02	4241	4390	4078
Fatness	18,836	2,933	3362.72	3090.99	17229	20768	32044
Asthma	8,868	496	394.70	581.51	5578	6074	5291
Osteoporosis	8,868	113	89.13	167.40	3470	3821	3186
Overweight	18,836	7,131	6779.08	7106.62	32719	32405	32044
House owner	12,231	7,130	7354.23	6746.18	21892	23635	19825
Tenant	12,231	4,423	3583.91	5130.50	9864	7086	12676
Female-headed households	12,231	187	258.57	184.24	3696	6310	2091
Health costs	12,231	1331742	281617.9	3349628	15852649	4875249	4875249
Lack of milk consumption	12,231	6,344	6674.73	5862.75	18314	19225	16942
Lack of fruit consumption	12,231	1,291	1900.19	921.22	4424	6351	2971
Divorced people	18,796	113	125.71	78.16	1484	1835	1204
Depression	3,515	1228	1273.81	1262.67	8460	8497	8568
Mental health	4,065	1213	1237.17	1244.56	8656	8522	8833
Anxiety	3,864	1231	1202.57	1328.89	8732	8262	9358
Social performance	3,585	936	1013.15	1018.12	6221	6532	5987
Physical building	3,840	1118	946.09	1213.52	8323	7887	8657
Smoker individuals	12,231	2775	2086.61	3217.19	6867	5493	27704
Accidents	12,231	988	661.46	1421.99	2577	1854	3527
Heavy expenses	12,231	623	733.62	779.50	3255	4463	3090
Below the poverty line	12,231	1955			7361		
Falling (health cost)	12,231	489			5795		
Falling (diagnosis cost)	12,231	73			7084		
Falling (visit cost)	12,231	73			7084		
Falling (hospital cost)	12,231	40			7209		

3. Descriptive statistics (data description)

An example of the table for describing the ratio of the all qualified individuals to the total individuals for the two groups (i.e. workers and Tehran people) is shown in table 5 that is the output of the software.

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Table 5. Descriptive statistics of the research

		Workers sample	Tehran sample
N	**Valid**	**27**	**27**
	Missing	**0**	**0**
Mean		**.16257**	**.18629**
Median		**.08078**	**.11760**
Mode		**.006**	**.005[a]**
Std. Deviation		**.172003**	**.178035**
Variance		**.030**	**.032**
Range		**.580**	**.652**
Minimum		**.003**	**.005**
Maximum		**.583**	**.657**
Sum		**4.389**	**5.030**

As the table 5 shows, the mean of the ratio for the workers is relatively lower than the mean of the ratio for the Tehran people. Accordingly we can conclude that probably the health level of the workers is higher than the people of Tehran. But we cannot reach to definite conclusion on the basis of the descriptive statistics, and so we have to conduct a statistical test to test the hypotheses.

4. Testing the hypotheses

In the output of the SPSS software we decide based on the significance level (abbreviated as the *Sig.*). Thus the reject point of the test is $Sig. \leq \alpha = 0.05$. In other words, whenever the calculated significance level is lower than the test error (5% or 0.05), then the null hypothesis is rejected; otherwise the null hypothesis is confirmed.

The best way of comparing the use of the measurement indicator is the *ratio*; so that for each area we divide the number of the qualified individuals to the total individuals who have been asked the question in order to obtain the indicator of the ratio. Then we will compare the ratios of the both groups (i.e. the workers and the Tehran residents). Since the two groups of the Tehran citizens and Tehran workers are related to each other, we have to use the dependent paired t- test for testing the hypotheses.

4.1. STATISTICAL TEST

4.1.1. Testing the first hypotheses:

Hypothesis: *There is a significant difference between the health of the Tehran workers and the health of the Tehran residents*.

To do this test, we consider the null hypothesis as the equality of the mean of ratio of the two groups, and the experimental test as the inequality of the mean of the ratio. In case of rejecting the null hypothesis, we will conclude that there is a significant difference between the health levels of the two groups. This process has been done in SPSS software and the results are shown in the following tables.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Workers	.16257	27	.172003	.033102
	Tehran	.18629	27	.178035	.034263

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Workers & Tehran	27	.975	.000

The above table presents the relevant statistics of the two samples. As shown in the first column, the means of the two samples are different.

Pair 1	Mean	Std. deviation	Std. error of the means difference	Distance of the 95% confidence of the means difference		t-value	df	Sig.
				Upper	Lower			
Workers Tehran	-0.02371	0.039761	0.007652	-0.039442	-0.007984	-3.099	26	0.005

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Again as shown in the above table, the significance level of the t-test is equal to 0.005 that is lower than the value of 0.05 (error level of the test). Thus the hypothesis of the equality between the ratios of the mean of the two samples is rejected at 5% level. Hence we can conclude that the ratio of the means of the workers is lower than the mean of the Tehran people ($\mu_1 < \mu_2$). So we can claim that the health level of the workers is higher than the people of Tehran.

4.1.2. Testing the second hypothesis

Second hypothesis: *There is a significant difference between the health level of the first quintile of the Tehran workers (poorest group) and the fifth quintile of the Tehran workers (richest group)*.

In order to test the truth of this hypothesis, we have to confirm that there is a significant difference between the ratios of the qualified individuals in the two groups. In this regard, we have considered the null hypothesis as the equality of the ratio between the means of the two sample groups and thus the experimental hypothesis is the inequality of the ratio between the means of the two samples.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 2	Q1-Workers	.18538	22	.179466	.038262
	Q5-Workers	.19766	22	.175079	.037327

The above table presents the relevant statistics of the two samples (i.e. the first quintile of the workers and the fifth quintile of the workers). As shown in the first column, the means of the two samples are different.

Paired Samples Correlations

		N	Correlation	Sig.
Pair 2	Q1-Workers &Q5-workers	22	.956	.000

This table shows the correlation coefficient of the two samples. As it is seen, the correlation coefficient is equal to 0.965 that is close to the value 1. This result implies the high correlation of the two samples; and since the significance level of the test (Sig.) is lower than 0.05, thus the null hypothesis (i.e. the lack of correlation between the two samples) is rejected

.

Pair 2	Paired Differences					t-value	df	Sig.
	Mean	Std. deviation	Std. error of the means difference	Distance of the 95% confidence of the means difference				
				Upper	Lower			
Q1-Workers Q5-Workers	-.01227	.04697	.010014	-.033101	.008551	-1.226	21	.234

Again as shown in the above table, the significance level of the t-test is equal to 0.234 that is higher than the value of 0.05 (error level of the test). Thus the hypothesis of the equality between the ratios of the mean of the two samples is accepted at 5% level. Hence we can conclude that there is no correlation between the richness and the health level in the sample of the Tehran workers.

4.1.3. Testing the third hypothesis

Third hypothesis: *There is a significant difference between the health level of the first quintile of Tehran people (poorest group) and the fifth quintile of the Tehran people (richest group)*.

In order to test this hypothesis, we have to confirm that there is a significant difference between the ratios of the qualified individuals in the two groups. In this regard, we have considered the null hypothesis as the equality of the ratio between the means of the two sample groups and thus the experimental hypothesis is the inequality of the ratio between the means of the two samples. If the null hypothesis is rejected, then we can conclude that there is a

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significant different between the health level of the two samples, i.e. the first quintile of Tehran people and the fifth quintile of the Tehran people. The output of the software is shown in the following table.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 3	Q1-Tehran	.22456	21	.186605	.040721
	Q5- Tehran	.23101	21	.177712	.038780

The above table presents the relevant statistics of the two samples (i.e. the first quintile of the Tehran people and the fifth quintile of the Tehran people). As shown in the first column, the means of the two samples are different.

Paired Samples Correlations

		N	Correlation	Sig.
Pair 3	Q1-Tehran&Q5-Tehran	21	.894	.000

This table shows the correlation coefficient of the two samples. As it is seen, the correlation coefficient is equal to 0.894 that is close to the value 1. This result implies the high correlation of the two samples; and since the significance level of the test (Sig.) is lower than 0.05, thus the null hypothesis (i.e. the lack of correlation between the two samples) is rejected.

Pair 3	Paired Differences					t-value	df	Sig.
	Mean	Std. deviation	Std. error of the means difference	Distance of the 95% confidence of the means difference				
				Upper	Lower			
Q1-Tehran Q5-Tehran	-.006452	.084213	.018377	-.044786	.031881	-.351	20	.729

As shown in the above table, the significance level of the t-test is equal to 0.729 that is higher than the value of 0.05 (error level of the test). Thus the hypothesis of the equality between the ratios of the mean of the two samples is accepted at 5% level. Hence we can conclude that there is no significant difference between the health level of the first and fifth quintile of Tehran people.

4.1.4. Testing the fourth hypothesis

Fourth hypothesis: *There is a significant difference between the health level of the first quintile of the Tehran workers (poorest quintile) and the first quintile of the Tehran people poorest quintile)*.

We have considered the null hypothesis as the equality of the ratio between the means of the two sample groups and thus the experimental hypothesis is the inequality of the ratio between the means of the two samples. If the null hypothesis is rejected, then we can conclude that there is a significant different between the health level of the two samples, i.e. the first quintile of Tehran workers and the first quintile of the Tehran people. The output of the software is shown in the following table.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 4	Q1-Workers	.18538	22	.179466	.038262
	Q1-Tehran	.21470	22	.187880	.040056

The above table presents the relevant statistics of the two samples (i.e. the first quintile of the workers and the firstquintile of Tehran people). As shown in the first column, the means of the two samples are different.

Paired Samples Correlations

		N	Correlation	Sig.
Pair 4	Q1-Workers & P1-Tehran	22	.942	.000

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This table shows the correlation coefficient of the two samples. As it is seen, the correlation coefficient is equal to 0.942 that is close to the value 1. This result implies the high correlation of the two samples; and since the significance level of the test (Sig.) is lower than 0.05, thus the null hypothesis (i.e. the lack of correlation between the two samples) is rejected.

Pair 4	Paired Differences					t-value	df	Sig. (2-tailed)
	Mean	Std. deviation	Std. error of the means difference	Distance of the 95% confidence of the means difference				
				Upper	Lower			
Q1-Workers Q1-Tehran	-.029321	.062958	.013423	-.057235	-.001407	-2.184	21	.040

As shown in the above table, the significance level of the t-test is equal to 0.04 that is lower than the value of 0.05 (error level of the test). Thus the hypothesis of the equality between the ratios of the means of the two samples is rejected at 5% level. Hence we can conclude that the ratio of the means of the first quintile of the workers is lower than the mean of the first quintile of Tehran people ($\mu_1 < \mu_2$). So we can claim that the health level of the first quintile of the workers is higher than the first quintile of the people of Tehra

4.1.5. Testing the fifth hypothesis

Fifth hypothesis: *There is a significant difference between the health level of the fifth quintile of the Tehran workers (richest quintile) and the fifth quintile of the Tehran people (richest quintile)*.

If the null hypothesis is rejected, then we can conclude that there is a significant different between the health level of the two samples, i.e. the fifth quintile of Tehran workers and the fifth quintile of the Tehran people. The output of the software is shown in the following table.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 5	Q5-Workers	.20553	21	.175372	.038269
	Q5-Tehran	.23101	21	.177712	.038780

The above table presents the relevant statistics of the two samples (i.e. the fifth quintile of the workers and the fifth quintile of Tehran people). As shown in the first column, the means of the two samples are different.

Paired Samples Correlations

		N	Correlation	Sig.
Pair 5	Q1-Workers & P1-Tehran	21	.964	.000

As the above table shows, the correlation coefficient is equal to 0.964 that is close to the value 1. This result implies the high correlation of the two samples; and since the significance level of the test (Sig.) is lower than 0.05, thus the null hypothesis (i.e. the lack of correlation between the two samples) is rejected.

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Pair 5	Paired Differences					t-value	df	Sig. (2-tailed)
	Mean	Std. deviation	Std. error of the means difference	Distance of the 95% confidence of the means difference				
				Upper	Lower			
Q5-Workers Q5-Tehran	-.025483	.047302	.010322	-.047015	-.003952	-2.469	20	.023

As the last table shows, the significance level of the t-test is equal to 0.023 that is lower than the value of 0.05 (error level of the test). Thus we conclude that the ratio of the means of the fifth quintile of the workers is lower than the mean of the fifth quintile of Tehran people. So we can claim that the health level of the fifth quintile of the workers is higher than the fifth quintile of the people of Tehran.

5. Conclusion

The main cause of the inequity of health is the socio-economic conditions and some other determining factors. Each of the inequity indicators shows the different conditions of the health in different socio-economic groups; thus the inequity in benefiting from the health services in the samples of the all families and the workers of Tehran will be different depending on the relevant indicator. Considering the five tests that have been conducted in this research we can conclude that the health level of the Tehran workers is higher than the families of Tehran. If we compare the poorest workers with the poorest people of Tehran on one hand and the richest workers with the richest people of Tehran we will come to the same conclusion. But when we conducted the comparisons within each sample group and compared the poorest group with the richest group within a single sample, we found that there is no significant difference between the means of the ration. This point implies that there is no significant difference between the health level of the poorest and richest groups, neither in the workers sample nor the sample of the Tehran people.

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Using of Precipitation infiltration for reclamation of rangeland (Case study: Chah-Hossein's Rangeland of Sabzevar/Iran)

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Abstract:

Chah-Hossein rangeland located in the southern city of Sabzevar/Iran has a dry climate and due to improper use of it, now, it course downward trend. In the fall of 2010 was carried out a project of range management in Chah-Hossein's region. Preliminary results showed in 2011, planting potted plants such as (Haloxylon, Nitraria and Atriplex) into furrow with fencing or protection was successful and after 6 months plant canopy covers from 24% to 25% and plant production from 54 kg/ha to 70 kg per hectare increased. However, due to low rainfall and drought in 2010 and 2011, the sowing and seed clump planting operation on the hillside did not achieve any considerable successes.

Key words: stores precipitation, Atiplex, Haloxylon, Nitraria

Introduction and Objectives:

Rangelands are belong to natural resources in the whole world and they are an excellent source of livestock feed. They play an important role in produce of fresh air, soil conservation, watershed hydrologic system setting, byproducts of medicine-industry, tourism and the protection of wildlife too. Whereof arid zone rangelands have an arid climate and its ecosystem is vulnerable, hence if these rangelands exploit, without proper planning or uncontrolled use, its vegetation will be destroyed and then the lands will be changed to desert and salt lands because of soil erosion. This action result in the poverty of the inhabitants of this ecosystems and in many cases, changing their jobs, and rural people migration. Now there are 107 million animal units grazing on Iran rangelands that are three times of grazing capacity for Irons' rangelands [6]. On the other hand, these days we can observe advancing desertification in arid, semi-arid, and sub-humid parts of Iran that its agents, first of all is human activities and then climate change. These phenomena not only in Iran but also in all countries on ground arid belt, have influenced the living more than 250 million people in whole world and the life of 1 million people in more than 100 countries have exterminated too [5]. Irons' rangelands that are about 86 million hectares [7] its most portions are arid and semi-arid regions and now because of existing economic –social problems and no balance between herbivores and vegetations, every day some portions of rangelands are replaced by deserts. On the other hand the best method for avoiding soil erosion is proper use of rangelands along with soil amendment. In the same way, Chah-Hossein's rangeland located 90 kilometers to south of Sabzevar/Iran is about 1300 hectares studied in order to researching and planting operation in December 2010. This project has 5 phases that ranger will do one of them per year. The last phase is scheduled to be implemented in 2014. this article shows the conclusion of the first phase that is surveyed in 2010 and 2011. Now, monitoring operation in the second year after planting, shows good results for soil conservation and avoiding desert progression.

Background of research:

Every year, many range and watershed projects carry out in many different states of Iran, but Chah-Hossein's project was carried out with helping people in south of Sabzevar for the first time in 2010. On the other hand, it is an extension and public participation project. The Project duration was 5 years and the first phase began in 2010. In the years 2010 and 2011, from the Khorassan-Razavi Jihad-Agriculture Organization Chief This project

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announced as premier project and its rancher introduced as the best and the most successful ranger in Khorasan-Razavi province too. Now this project is a good sample and template for other Sabzevar rangers living around the Chah-Hossein's rangeland.

Materials and method:

Chah-Hossein's rangeland is a portion of Dowlatabad watershed. Its geographic situation is in the south of Sabezevar city/Iran (Long: 57°, 25' E; 35° ,37' N) (Fig.1).

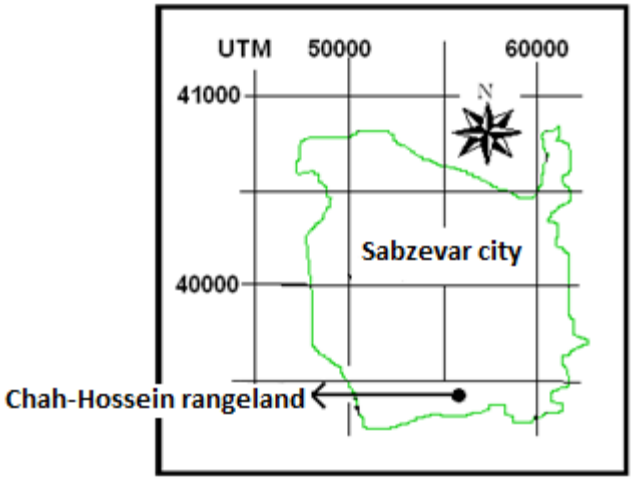

Fig 1. Chah-Hossein situation in Sabzevar zone/Iran

This study has some section as follows [1]:

1. Physiographic and topographic studies:

In this section, first we drew the border of region on topographic map to a scale of 1:50,000. Then all maps as slope, aspect, hypsometry and drainage density prepared by GIS software and at the end all of information belong to height (min, mid, max), slope, aspect, drainage density and hypsometry provided [1,2] (Table 1).

Table 1. Chah-Hossein's physiography and topography

Average slope	Drainage density	Height			
12.4%	13.23 km.km^{-2}	Min	Mid	Max	area
		1461 m	1562 m	1420 m	1300 hectare

2. Climatic and meteorological studies

After physiographic study we did climatic and meteorological studies. Table 2 shows some parameters as precipitation distribution, average precipitation, wind speed, wind direction, the strongest wind, temperature, climate, evaporation and other parameters related to this section [1].

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Table 2. Chah-Hossein's climatic and meteorological characteristics

precipitation distribution		evaporation		The strongest wind direction	Climate (Demarton Method)	Temperature			Average precipitation
low	high	actual	potential	18.8 $m.se^{-1}$ Eastern	Arid	Min	Average	Max	186 mm
Aug-Sep	Jan-Feb-Mar	206 mm	2157 mm			-5	14.4	42.4	

3. Geology and soil science studies

Other studies provided in Chah-Hossein's project were geology and soil science that their conclusions have indicated in Table 3 [1].

Table 3. Geology and soil science characteristics for Cah-Hossein's region

run off	electrical conductivity (Ec)	humidity trend	thermal trend	soil depth	soil texture	erosion	parent material	period	era
moderate	0.89 $ds.m^{-1}$	xeric	Thermic	0-40 cm	Loam-sand	high	sand stone-marl	Quaternary	Cenozoic

4. Vegetation studies

Vegetation studies provided on the base of taking samples. After taking random samples of canopy cover plants, we could determine some factors as plant type names, and percentage of (canopy cover, litter, bare soil, rock, range condition and trend) and then by means of clipping method we calculated biomass too [1] (Table 4).

Table 4. Chah-Hossein's vegetation characteristics before reclamation

Capacity	Trend	Condition	% bare soil	% litter	% rock	% canopy cover	Main species
54 $kg.ha^{-1}$	downward	Poor	52	5	19	24	Lactuca sp-Gundelia torneforti

5. Reclamation and operational activities

After incorporating all of studies, the final results carried out in Chah-Hossein's area. At first, the region divided in two parts (plain and hillside). Into the plain area that it's slope is less than 10% some operational works carried out as follows. First, the distance of 5 meters by 5 meters were constructed many parallel groove contours. Then inside the furrows to a distance of 3 meters by 3 meters, cultivation pot including (Atriplex canescens, Holoxylon persicum and Nitraria schoberi were cultured. The gaps between pot cultivations were sowed with Artemisia seed too. From planting time (December 2010) until June 2010, all furrows were irrigated 2 times by water tanker. Initial irrigation carried out immediately after planting and the second irrigation was done in December 2010. On the hillsides that slope factor is more than 10% we used of seed clump planting method. In this method, first many small pits to distance 30 cm to 50 cm each other were dug out by a hatchet. Then we laid 5 or 7 mix seeds belong to 3 species as (Artemisia sieberi, Astragalus siliquosus and Salsola rigida) down into every pit and then the pits covered with soil by back of the hatchet. The depths of pits were about 3 or 5 cm. After planting the first phase, the area conserved and ranchers kept the planting

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area out the reach of sheep and goats for 2 years until the seeds and seedlings have been had an enough opportunity to grow and establish Away from livestock access [1].

6. Monitoring

According to research objectives and operational works, after planting, the monitoring activities carried out in the first phase, every 2 months. Monitoring function involves the measurement of plant establishment, height of seedlings, plant canopy covers and biomass production.

Result and discussion:

The results of the monitoring (from planting time until July 2010) showed, despite a drought in the region during years of 2010 and 2011, more than 95% of cultivated bushes could endure heat and drought and settled. According to our measurements, on average, about 1%, plant canopy covers increased than prior to planting. This amount is equal to 100 square meters per hectare (Table 5).

Table 5. The canopy cover percentage before and after planting in Chah-Hossein's area (phase of 1)

Bare soil% & rock%	Litter %	Canopy cover%	Biomass $Kg.ha^{-1}$	Plant type	
71%	5%	24%	54	Before planting	Artemisia sieberi
70%	5%	25%	70	After planting	

Clipping method for measuring biomass, in the phase of 1 indicated, plant biomass had an increase about 16 kg/ha than prior to planting (Table 5). In other words, it is equal of 77% growth. In conjunction with sowing and seed clump planting, despite the fact that a little water trapped inside the furrows after winter rainfalls, the results showed due to severe drought and high temperature (35^{oC} to 40^{oC}) in planting year, more than 90% of planting seeds into the furrow floors and on the hillsides, did not grow, and only 10% of seeds of furrow insides and on the hillsides could established. This shows in arid zones with less than 200 mm annual precipitation and improper rainfall distribution in hot months as June, July, August and September that water requirement of seedlings are high, the seedlings cannot establish and seed sowing operation is not affordable and successful.

Suggestion:

Soil and water are the most important natural resources of any country and life depend on them. They need to be protected. Sustainable utilization of rangelands, soil and water is related to correct use of miracle of God. To succeed in reaching this particular goal, the ranchers should make an effort for correct use of natural productions according to condition, trend and potential of plants and nature. Besides, the ranchers should carry out range and watershed projects beside the proper use of rangelands. It is very important that ranchers pay attention to range condition, range trend and rotation grazing system, because consideration of rangeland details can improve plant species composition, soil and water conservation, and in the end, we can achieve to sustainable utilization [3, 4].

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