
**Journal of Environmental Sciences Studies**

Journal home page: www.jess.ir

# Feasibility study of using optimally the wastewater from a refinery in Hakimieh neighborhood

**Seyed Mohammad Amin Hosseinipour[1*], Reza Khalili [2]**

1*- Organizational Instructor of Imam Hossein University

2- M.Sc. in Civil Engineering and Water Resources Management

*Email Address: amin.hosseinipour@gmail.com

Received: (June -01-2021)

Accepted: (June -24 -2021)

**Abstract**

There is an increasing demand and deficiency of water resources, accordingly, it is possible to solve this problem through reusing refined wastewater for various objectives. This study is conducted in order to feasibility study of reusing the wastewater of Hakimieh neighborhood treatment plant/refinery to be applied in different applications. Accordingly, we tested the parameters of temperature, COD, BOD, TSS, TDS, EC, pH, nitrate, phosphate, turbidity, color, salinity, and fecal and gastrointestinal coliforms and analyzed the quality data of the wastewater discharged from the treatment plant for the feasibility of consumption Irrigation, agriculture, discharge to surface and groundwater based on the environmental protection standard and CWQI water quality index We also examined and evaluated the risk analysis of using discharged wastewater for various objectives using the William Fine model The results indicated that the quality of discharged wastewater based on the CWQI water quality index is comparatively moderate and is placed in borderline and is not proper for irrigation, agricultural applications, and discharge to surface and groundwater because of the high amounts of TDS, EC, nitrate, and phosphate TDS, phosphate, and nitrate parameters in the wastewater are also required to be corrected immediately based on the results of risk analysis.

**Keywords**

Feasibility Study, Wastewater Treatment Plant, CWQI Water Quality Index, William Fine Model, Hakimieh neighborhood

## 1. Introduction

Currently, natural water resources have experienced high pressure because of increasing population growth and higher demand to produce more (Khalili, et al. 2021). Furthermore, the industrialization of communities has created a lot of water pollution and irreversible damages to the environment and has increased the problem of water scarcity day by day (Prasad et al. 2020). Urban and industrial wastewater polluted with biodegradable organic matter, chemicals, heavy metals, toxins, and pathogens is discharged into oceans, rivers, lakes, and wetlands without treatment that is unallowable and pollutes water sources in some communities. (Khalili et al. 2021). Water resources are also significantly polluted through increasing the use of chemical fertilizers and pesticides in agriculture (Feng, et al. 2019). These pollutions penetrate the soil, plants, and living organisms through water and enter the human food chain (Jaiswal et al. 2019). Consuming polluted water has seriously and dangerously affected our lives so that more than 5 million people (mostly children) die because of diseases caused by drinking unhealthy water around the world each year

(Ahmad et al. 2020). The number of countries suffering from water scarcity has been increased during the last four decades that include mostly developing countries (Khalili, et al. 2020). Accordingly, organizations and water experts consider required to take measures such as demand management, increasing social awareness, supply management, cost prioritization, return water use, increasing water efficiency in order to optimally manage water resources and obtain the wanted state and satisfy water needs in the future. (Talbi and Kachi 2019). There are significant solutions in this field including supplementary treatment and reuse of wastewater that reduce surface and groundwater consumption and also decrease water pollution (Baghaie and Aghili 2018). Currently, it is possible to refine most of the generated wastewater and return the refined and treated water waste to the reuse cycle due to advancing technology and inventing advanced wastewater treatment methods (Hoang et al. 2020). The mean annual precipitation of 240 mm in Iran compared to 860 mm of mean precipitation in other parts of the world shows that our country is one of the arid and semi-arid countries (Li, Chen, and Teng 2020). Iran is located in a region with low water in the world and has limitation to access to water resources in its large parts, hence, using refined wastewater for various objectives can be a highly useful and cost-effective option to supply the water required by different sectors and also can maintain the natural water resources and stops water loss and environmental pollution (Khalili, et al. 2021). The feasibility study of reusing wastewater and returned water in different applications in this regard and determining qualitative constraints is one of the significant aspects of planning to use this resource (Kang et al. 2019). It is an international activity to reuse refined wastewater from wastewater treatment plants with different applications such as irrigation, recreational and urban applications, groundwater feed, industrial applications, etc. Accordingly, it is possible to define indices as a measured or observed feature that provides useful management information about the process related to environmental conditions (Şener, Şener, and Davraz 2017).Applying existing standards and water quality indices, which are instruments to express cumulative mathematical terms that have been derived to define a specific level of water quality is one of the simplest approaches to evaluate the state of water quality. Water Quality Index (WQI) was identified during the time and it is possible to use it as an ecological sign in different ways, and William & Fine Method is used as one of the most essential assessments, risk rating, and management. It is required to use this method in order to decide on the necessity and justification of costs to control the risk and also the necessity to implement the programs to control the risk as soon as possible. Farahani et al. (2012) examined the feasibility study of reusing the treated wastewater of the Islamic Azad University, Roodehen Branch, for the green space of the university. They measured the quality parameters of raw and refined wastewater of the university for 3 months and then compared the obtained results with the Iranian green space irrigation standard. The achieved results indicated that all the parameters of the wastewater discharged from the treatment plant except the TSS parameters and all coliforms are according to the principles of the Iranian environment irrigation standard. Furthermore, the EC level and ultimately, the calculated SAR index of this wastewater were dangerous in terms of salinity for irrigation; consequently, if the procedure and implementation of treatment operations be changed to reduce the soluble solids and total coliforms, we can use this wastewater in a limited way to irrigate plants that are less sensitive to salinity (Farahani and Maki Al-Agha 2012).Hassani et al. (2013) evaluated the physical, chemical, and microbial parameters of the treatment plant wastewater seasonally during one year and then, compared parameters with the standard of the Environment Organization of Iran, WHO, FAO, and EPA in another study to the feasibility study of reusing refined wastewater (Case study of the wastewater of Shemiranat area of Tehran) to feed groundwater and irrigation. Ultimately, we were able to observe that ammonia, high TDS, and a high number of coliforms caused that the quality of wastewater to be improper for groundwater recharge. The high electrical conductivity of the wastewater makes it improper for irrigation according to the cultivation pattern of the region (plants sensitive to soil salinity). The coliform pollution makes wastewater improper for discharge in the Afjeh River and also because villagers use it downstream. Ultimately, it was recommended that additional treatments be performed to improve the quality of the treated wastewater (Hassani et al. 2013).Dehghani firoozabadi et al. (2017) conducted investigations to study the feasibility of reusing the treated wastewater in one of the industrial towns of Yazd province (Jahanabad Meybod industrial town) to apply in agricultural and irrigation sections. Accordingly, they collected the mean values of quality parameters of registered sampling of treated wastewater from August to September 2012 and compared with the standard of the Environment Organization of Iran and analyzed in Excel. They realized that except for BOD5 and COD parameters, all other parameters are in the standard range and permissible limits for agricultural and irrigation applications (Dehghani firoozabady et al. 2017).Roodbari et al. (2017) conducted studies to assess the quality of the wastewater discharged of the Ekbatan wastewater treatment plant (to be used in agricultural irrigation). They evaluated 22 physical and chemical indices and 3 microbial indices for 48 months using the CWQI index to assess qualitatively the treated wastewater. Then, they entered the achieved results into the CWQI Calculator program to compare with the Environment Organization of Iran's standard. The results revealed that the CWQI values are 30, 38, 56, and 53, respectively for drinking, aquaculture, agricultural irrigation, livestock, and poultry feed; this quality is not approved at all for drinking and aquaculture, and also the amount of this index for agricultural irrigation and feeding livestock and poultry is in the border quality (Roodbari, Javid and Qomi Maghsad 2017).Hatami et al. (2018) examined the feasibility study of reusing the wastewater of wastewater treatment in Bojnourd to use in the agricultural field. Accordingly, they collected the parameters EC, COD, BOD, TSS, TDS, SAR, pH, nitrogen, phosphorus, percentage of sodium, magnesium ions, potassium, calcium, sodium, and chloride from the treatment plant for one year. Then, they compared the collected parameters with the Iranian environmental standard, WHO, and FAO to determine this fact that this wastewater is proper for agriculture or not. Ultimately, they realized that all parameters are in the right range for irrigation except the chloride parameter that had a comparatively high concentration according to the FAO standard; hence, it is not possible to irrigate all agricultural products with this wastewater, and it is required to pay attention to the planting type of crop and it is required to cultivate plants that are less sensitive to salinity such as wheat, barley, dates, corn, grapes, olives, pomegranates, cotton, figs, etc. (Hatami et al. 2018).The data relating to qualitative parameters of the wastewater discharged of the treatment plant of Imam Hossein Military and Education University have been analyzed in this study and finally, its feasibility study for irrigation, agriculture and discharge to surface and groundwater according to environmental protection standards and water quality index of CWQI have been evaluated and the risk of using wastewater has been ultimately analyzed using the William Fine model.

## 2- Research methodology

### • Sampling method and chemical analysis

Sampling was performed and analyzed in two stages before and after chlorination on the wastewater of the Hakimieh treatment plant. Sampling parameters in this study include temperature, COD, BOD, TSS, TDS, EC, pH, nitrate, phosphate, turbidity, color, salinity, and fecal and gastrointestinal coliforms. Table (1) indicates the method to measure and devices that have been used to measure the physicochemical parameters of the samples.

**Table 1 - Instruments and methods to measure the studied parameters**

| Parameter | unit | Analysing method |
|---|---|---|
| **pH** | - | pH meter Metrohm model |
| **COD** | (mg/l) | Photometer |
| **BOD** | (mg/l) | Photometer |
| **TSS** | (mg/l) | Method standard |
| **TDS** | (mg/l) | Multimeter |
| **F. COLIFORM** | (MPN) | Manual |
| **T. COLIFORM** | (MPN) | Manual |
| **EC** | (µs/m) | Multimeter |
| **Turbidity** | (NTU) | Turbidity meter |
| **nitrate** | (mg/l) | Photometer |
| **phosphate** | (mg/l) | Photometer |
| **color** | (mg/l) | Photometer |
| **salinity** | (PPM) | Instruments Ltd HANNA test kit |
| **temperature** | ($C^O$) | Mercury Therommeter |

**• The quality control of analysis**

Table 2 shows the standard values of the Iranian Environmental Protection Agency IRNDOE, WHO, EPA, and FAO.

**Table 2: Standards of Iran Environmental Protection Organization IRNDOE, WHO, EPA, and FAO**

| Parameter | unit | Allowable limit in WHO standard | Allowable limit in EPA standard | Allowable limit in FAO standard | Allowable limit in Iranian standard IRNDOE | | |
|---|---|---|---|---|---|---|---|
| | | Irrigation | | | Agriculture and Irrigation | Groundwater | Surface water |
| **pH** | - | 6-8/5 | 6/5-8/4 | 6-8/5 | 6-8/5 | 5-9 | 6-8/5 |
| **COD** | (mg/l) | 120 | 120 | 100 | 200 | 60 | 60 |
| **BOD** | (mg/l) | - | 30 | 20 | 100 | 30 | 30 |
| **TSS** | (mg/l) | - | 5 | - | 100 | - | 40 |
| **TDS** | (mg/l) | 450 | - | 450 | - | Note 2 | Note 1 |
| **F.COLIFORM** | (MPN) | - | - | 500 | 2 | 400 | 400 |
| **T.COLIFORM** | (MPN) | 1000 | 200 | 1000 | 500 | 1000 | 1000 |
| **EC** | (µs/m) | 700 | 700 | 700 | 500 | 500 | 500 |
| **Turbidity** | (NTU) | 5 | 2 | 5 | 50 | - | 50 |
| **nitrate** | (mg/l) | 5 | 30 | - | 10 | 10 | 50 |
| **phosphate** | (mg/l) | - | 30 | 5 | 6 | 6 | 5 |
| **color** | (mg/l) | - | - | - | 75 | 75 | 75 |
| **salinity** | (PPM) | Note 3 | | | | | |
| **temperature** | $C^{O}$ | 12-17 | | | | | |

Note 1: It will be possible to discharge with a concentration higher than the amount specified in the table if the discharged wastewater does not enhance the concentration of chloride, sulfate, and soluble materials of the receiving source in a radius of 200 meters at more than ten percent. Note 2: It will be possible and permissible to discharge with a concentration higher than the amount recognized in the table if increasing the chloride, sulfate, and soluble substances in the effluent compared to the water consumption is not more than ten percent.Note 3: It is required that the temperature to be in a way that the temperature of the receiving source does not increase or decrease more than 3 degrees Celsius within a radius of 200 meters from the location of entry.

**• CCME-WQI Water Quality Index:**

CCME-WQI Water Quality Index is one of the most significant indices to assess the surface water in order to protect the aquatic ecosystems and water consumers. Council of the Canadian Ministry of Environment provided and established the C-WQI Water Quality Index in 1990 to assess the water quality (Manii and Al-Zubaidi 2013). This index studies the water quality according to the required physical, chemical, and biological parameters. It is essential to state that this method has no parameter limitation and more parameters will improve the accuracy of the assessment. The Canadian Quality Index is expressed as a number between zero and 100. A higher value of this index will improve the quality of the tested water tested (Wagh et al. 2019).

**• Relationships and equations directing the CCME-WQI model:**

$$\text{CCME-WQI} = 100 - \left(\frac{\sqrt{F_1^2 + F_2^2 + F_3^2}}{1.732}\right) \quad (1)$$

Factor F1 = shows the percentage of variables that are in agreement with the observations at least once during the time period and is calculated using Equation 2.

$$f1 = \left(\frac{Number\ of\ failed\ variables}{Total\ Number\ of\ variables}\right) * 100 \quad (2)$$

Factor F2 = shows individual tests that are not in agreement with the observations and are calculated using Equation 3.

$$f2 = \left(\frac{Number\ of\ failed\ test}{Total\ Number\ of\ variables}\right) * 100 \quad (3)$$

Factor F3 = shows the number of rejected tests that are not in agreement with the observations. This factor is calculated in three steps

Step 1: Calculating the deviation rate of the values rejected by the standard in situations where the test values are required not to exceed the standard values.

$$\text{Excursion } i = \left(\frac{Faild\ test\ value\ i}{Objectine\ j}\right) \quad (4)$$

If the test values are required not to be less than the standard values.

$$\text{Excursion } i = \left(\frac{Objectine\ j}{Faild\ test\ value\ i}\right) - 1 \quad (5)$$

**Step 2**: It is possible to calculate the cumulative amount of tests without function by adding the deviations of the number of separate observational tests to the total number of tests. Equation 6 is applied to calculate these variables that are known as the sum of normalized deviations.

$$\text{nse} = \left(\frac{\sum \text{excurison}}{\text{total number of tests}}\right) \quad (6)$$

**Step 3:** Factor F3 can be calculated after performing the above steps using Equation 6, which has a range of 0-100 (Farhan et al. 2020).

$$f3 = \left(\frac{nse}{0.01nse + 0.01}\right) \quad (7)$$

**Table 3: Classifying water quality index and interpreting its suitability in CCME-WQI index**

| Classifying the index | Qualitative range | Interpreting the water suitability and quality conditions |
|---|---|---|
| **excellent** | 95-100 | The quality of water has been protected by high threats and disruptions. Conditions are very close to natural and original levels. |
| **good** | 80-94 | Water quality has been protected in the medium and border limit from threats and disruptions. Conditions are seldom out of normal and original levels. |
| **medium** | 65-79 | Water quality has been normally reserved but is sometimes threatened and disrupted. Sometimes, conditions are out of natural and original state. |
| **Comparatively moderate or borderline** | 46-64 | Water quality is constantly threatened and disrupted. Conditions are frequently out of the natural and original state. |
| **weak** | 0-44 | Water quality is almost constantly threatened or disturbed. Conditions are usually out of the natural and desirable state. |

It is required to extract the rating the consequence intensity, rating the risk probability, and an exposure rating related to each activity and its features according to the tables related to the mentioned method in order to assess the risk by William Fine method. In this method, the risk score is calculated based on the tables to rate the consequence intensity, rating the occurrence probability, and rating the exposure rate, and by calculating their product.

Risk Assessment Equation of William Fine Model:

$$R = E \times P \times C \quad (8)$$

In this Equation:

E: The amount of contact

P: Probability of occurrence

C: Intensity of consequence

R: Risk

**Table 4: Exposure rate**

| Class | Description of the exposure rate (E) | Score |
|---|---|---|
| 1 | Continually- several times a day - exposure more than 6 hours a day - constant emission of pollutants | 10 |
| 2 | Often - several times a week - exposure between 8 to 6 hours a day - high emissions of the pollutant | 6 |
| 3 | Occasionally - several times a month- Exposure between 0 and 8 hours per day - Moderate emissions of the pollutant | 3 |
| 4 | Unusual - Several times a year - Exposure between 3 and 0 hours per day - Non-routine emission of pollutants | 2 |
| 5 | Rarely - once every few years - Exposure between 7 and 3 hours a day - Low emissions of pollutants | 1 |
| 6 | Partially - very little - Exposure less than 7 hours per day - Insignificant emission of pollutants | 0/5 |
| 7 | No exposure- no frequency of occurrence - no emission of pollutants | 0/2 |

**Table 5: Probability of risk occurring/ probability of effect of harmful factors**

| Raw | Description of Probability of risk occurring (p) | score |
|---|---|---|
| 1 | It is certain | 10 |
| 2 | It is highly possible | 8 |
| 3 | The probability of occurrence is 50% / it is possible | 5 |
| 4 | It occurs sometimes | 3 |
| 5 | It can occur by accident/chance of occurrence is less than 50% | 1 |
| 6 | It is not probably happened until a few years after the exposure, but it can occur | 0.5 |
| 7 | It is essentially impossible / it never occurs | 0.1 |

**Table 6: Intensity of risk consequence**

| Raw | Describing the Intensity of risk consequence(c) | Score |
|---|---|---|
| 1 | Death of several people - Irreversible environmental damage that has long-term consequences- Financial damages and losses at more than 150 million toman- International influence on the | 100 |
| 2 | Death of one person - Damage resulted in continuing disability of more than one person - Irreversible environmental damages that have medium-term effects - Financial losses and damages between 100 to 150 million Tomans - effect on the organization's reputation nationally - Moderately high consumption of resources and energy - Moderately high concentration of pollutants (30 Percent higher than standard rate) | 50 |
| 3 | Damage that results in person's permanent disability - Irreversible environmental damage that has short-term effects - Financial losses between 50 to 100 million Toman- effect on the organization's reputation as a province - High consumption of resources and energy - High concentration of pollutants (10% more than standard rate) | 25 |
| 4 | Long-term damage with no permanent disability - Compensable environmental damage that has long-term effects - Financial losses between 5 to 50 million Toman- effect on the organization's reputation locally - Consuming averagely resources and energy - Average concentration of pollutants (5% more than standard rate) | 15 |
| 5 | Temporary damage - Compensable environmental damage that has short-term effects - Financial losses less than 5 million Toman- effect on the organization's reputation within the organization- Low resource and energy consumption - Pollutant concentration less than 5% higher than the standard rate | 5 |
| | organization's reputation- Extremely consuming the resources and energy - Excessive concentration of pollutants (50% more than standard rate) | |
| 6 | Partial damage that requires first aid (3 days or less) - Financial loss less than 1 million Toman- effect on the organization's reputation as a unit - Consuming low resources - Concentration of pollutants within the standard rate | 2 |
| 7 | There is no requirement to conduct further research- Insignificant financial losses - No effect on organizational reputation - No environmental damage - consuming no resource - Concentration of pollutants less than the standard rate | 1 |

Then, we collect the risk number using William Fine formula and compare it with Table (7) and calculate the level of risk.
Finally, we provide the control objectives and plans and corrective measures for the risks with level H to reach the level of M or L according to the importance of the risks, then we provide the control objectives, and the control plans for the risks with level M to reach the level of L, and we control them constantly after reaching the risks to an acceptable level (L level).

**Table 7: Risk level rating**

| Rate | Measures | Risk level | statue |
|---|---|---|---|
| >400 | It is required to perform instant corrections to control the risk | High | |
| 150-399 | Emergency - It is required to pay attention as soon as possible | Middle | |
| <150 | The risk is monitored and controlled | Low | |

## 3- Results

Table 8 shows the results achieved by analyzing the temperature parameters, COD, BOD, TSS, TDS, EC, pH, nitrate, phosphate, turbidity, color, salinity, and fecal and gastrointestinal coliforms.

**Table 8: Chemical and microbiological analysis of wastewater discharged by the wastewater treatment plant of Imam Hossein University of Military and Education**

| Parameter | Unit | Entering wastewater | Average values of discharged wastewater |
|---|---|---|---|
| pH | - | 5/9 | 7/1±0/1 |
| COD | **(mg/l)** | 198 | 63±3 |
| BOD | **(mg/l)** | 110 | 25±4 |
| TSS | **(mg/l)** | 80 | 28±3/5 |
| TDS | **(mg/l)** | 1288 | 650±25 |
| F. COLIFORM | **(MPN)** | >2400 | 830±110 |
| T. COLIFORM | **(MPN)** | >2400 | 1220±140 |
| EC | **(µs/m)** | 2448 | 850±125 |
| Turbidity | **(NTU)** | 221 | 8±5 |
| Nitrate | **(mg/l)** | 72.5 | 18 ±4/2 |
| Phosphate | **(mg/l)** | 24 | 7±3/2 |
| Colour | **(mg/l)** | 178 | 68±100 |
| Salinity | **(PPM)** | 3200 | 550±100 |
| Temperature | **$C^O$** | 16 | 15±1/5 |

As the above table and comparing the standards of the Environmental Protection Organization of Iran, IRNDOE, WHO, EPA, and FAO show the parameters of BOD, turbidity, and phosphate are at the border limit, and the parameters of TDS, EC, and nitrate used in exceeding irrigation uses WHO standard, BOD parameters, TDS, TSS, EC and turbidity used in over-irrigation uses of EPA standard, BOD parameters, turbidity, and phosphate used in the limit range and TDS, EC, TSS and nitrate parameters used in FAO standard over-irrigation uses. As Iran IRNDOE standard in irrigation and agriculture sections explain, TDS, EC, and excessive nitrate parameters were higher than the standard rate, TDS, EC, nitrate, and phosphate parameters for groundwater injection are higher than the standard rate and also COD, TDS, EC and phosphate parameters that have been used to release in surface waters have been higher than the standard rate that using this wastewater will impose many risks to the environment. Assessing and informing about water quality is one of the most significant steps to manage the water resources optimally along with sustainable development standards. Using the CWQI model has been introduced as a comprehensive and extensive test to evaluate the quality of water resources for different uses. It is possible to use this model as an index to evaluate the optimal management of water resources. Table 9 shows the results achieved by the CWQI water quality index.

**Table 9: Results of analysing the discharged wastewater parameters to determine the quality class of discharged wastewater**

| $F_1$ | $F_2$ | nse | $F_3$ | CWQI |
|---|---|---|---|---|
| **20/3** | 19/9 | 0/16 | 17/7 | 66/57 |

According to Table (9), the quality of wastewater discharged from the treatment plant of Hakimiyeh has been in a relatively average quality classification and borderline.
The results of wastewater discharge risk of Hakimiyeh treatment plant in the table (10) are related to discharge to surface water, table (11) related to discharge the wastewater to be used for agricultural and irrigation objectives, and table (12) related to discharge to groundwater, respectively.

**Table 10: Results of discharge risk to surface water**

| Statue | R | C | P | E | Unit | Qualitative parameter |
|---|---|---|---|---|---|---|
| **L** | **0/02** | **1** | **0/1** | **0/2** | **(mg/l)** | **pH** |
| **L** | **2/5** | **5** | **0/5** | **1** | **(mg/l)** | **COD** |
| **M** | **300** | **50** | **3** | **2** | **(mg/l)** | **BOD** |
| **L** | **1/25** | **5** | **0/5** | **0/5** | **(mg/l)** | **TSS** |
| **H** | **450** | **50** | **3** | **3** | **(MPN)** | **TDS** |
| **M** | **300** | **50** | **3** | **2** | **(µs/m)** | **EC** |
| **L** | **0/5** | **2** | **0/5** | **0/5** | **(NTU)** | **Turbidity** |

| | | | | | | |
|---|---|---|---|---|---|---|
| L | 15 | 5 | 3 | 1 | (mg/l) | Nitrate |
| H | 750 | 50 | 5 | 3 | (mg/l) | Phosphate |
| M | 300 | 50 | 3 | 2 | (PPM) | Colour |

**Table 11. Risk Results to use in agriculture and irrigation**

| Statue | R | C | P | E | Unit | Qualitative parameter |
|---|---|---|---|---|---|---|
| L | 0/2 | 2 | 0/5 | 0/2 | (mg/l) | pH |
| L | 25 | 25 | 1 | 1 | (mg/l) | COD |
| L | 60 | 15 | 3 | 2 | (mg/l) | BOD |
| L | 0/02 | 1 | 0/1 | 0/2 | (mg/l) | TSS |
| M | 235 | 25 | 3 | 3 | (MPN) | TDS |
| M | 450 | 50 | 3 | 3 | (µs/m) | EC |
| L | 0/04 | 2 | 0/1 | 0/2 | (NTU) | Turbidity |
| H | 450 | 25 | 3 | 6 | (mg/l) | Nitrate |
| M | 375 | 25 | 5 | 3 | (mg/l) | Phosphate |
| L | 12 | 2 | 1 | 0/5 | (PPM) | Colour |

**Table 12: Results of discharge risk to groundwater**

| Statue | R | C | P | E | Unit | Qualitative parameter |
|---|---|---|---|---|---|---|
| L | 0/02 | 1 | 0/1 | 0/2 | (mg/l) | pH |
| L | 2/5 | 5 | 0/5 | 1 | (mg/l) | COD |
| M | 300 | 50 | 3 | 2 | (mg/l) | BOD |
| L | 1/25 | 5 | 0/5 | 0/5 | (mg/l) | TSS |
| H | 450 | 50 | 3 | 3 | (MPN) | TDS |
| M | 300 | 50 | 3 | 2 | (µs/m) | EC |
| L | 0/5 | 2 | 0/5 | 0/5 | (NTU) | Turbidity |
| M | 270 | 15 | 3 | 6 | (mg/l) | Nitrate |
| M | 375 | 25 | 5 | 3 | (mg/l) | Phosphate |
| M | 300 | 50 | 3 | 2 | (PPM) | Colour |

As Tables, 10-12 explain, the parameters of TDS and phosphate in surface water discharge, nitrate parameter in agricultural and irrigation uses, and TDS in groundwater injection require to perform immediate corrections in order to control the risk and if it is neglected, irreversible risks will be created for the environment.

**4- Discussion and conclusion:**

Iran is located in an arid and semi-arid region, and there are problems related to water shortage and the decline of surface and groundwater, hence, it is essential to reuse treated wastewater. Accordingly, industrial wastewater is very significant due to its various and dangerous pollutants, consequently, it is required to seriously considered and examined the necessity for proper wastewater treatment and efficient management of produced wastewater. This research has examined the feasibility study of reuse wastewater of Imam Hossein University's refinery. The data on the quality parameters of the entering wastewater and effluent discharged from the treatment plant has been studied and examined and its feasibility has been studied and assessed for various uses and discharge to surface and groundwater according to the environmental protection standard and applying water quality index. The next section analyzes the discharged wastewater risk for discharge using the William Fine model.*** As the obtained results explain, the efficiency of anaerobic biological removal and extended aeration for the quality parameters of BOD, COD and TSS was about 75% and the average pH was 7.1 mg / l. According to the obtained results, the concentration of quality parameters of this treatment plant is not within the standard rate and allowable limits to use in irrigation and agricultural sections, but it will be allowable to use this wastewater in the case of reducing the nitrogen for artificial feeding of aquifers and also discharge of this wastewater in surface water due to the higher concentration of CO, EC and phosphate parameters is higher than the standard rate, and it is possible that the permanent discharge of this wastewater into the river damage the environment.*** According to the calculations of the CWQI water quality index, the discharged wastewater has classified in the medium and border quality level and it is not allowable to use it to irrigate green space, in agriculture, and for livestock in case of long-term use.**** Analyzing the performed risk shows that the parameters of COD, BOD, TDS, phosphate, and nitrate have a high risk for discharge in surface and groundwater. TSS parameter, pH, and turbidity had the lowest risk rate.

**References:**

- Hassani, Amir Hesam, Mahmoud Salari, Amir Hossein Javid, Mojtaba Sayadi and Zohreh Bahramnejad. 2013. "Feasibility study of reusing the wastewater discharged from Anbaj wastewater treatment plant to be applied in various objectives emphasizing artificial groundwater recharge." Journal of Environmental Geology 7 (22): 27–38.

- Roodbari, Ali Akbar, Allah Bakhsh Javido, and Niloufar Qomi Maghsad. 2017. "Evaluating the wastewater quality of Ekbatan wastewater treatment plant to use it again in agricultural irrigation applying CWQI model." Journal of Knowledge and Health 12 (3) 25–34.
- Farahani, Maryam and Mina Maki Al-Agha. 2012. "Evaluating the possibility of reusing the treated wastewater of the Islamic Azad University of Roodehen Branch in irrigating the green space of this complex." Plants and Ecosystems 8 (33): 41–50.
- Ahmad, Kashif, Said Muhammad, Wajid Ali, Ishtiaq A. K. Jadoon, and Atta Rasool. 2020. "Occurrence, Source Identification and Potential Risk Evaluation of Heavy Metals in Sediments of the Hunza River and Its Tributaries, Gilgit-Baltistan." Environmental Technology & Innovation 100700.
- Baghaie, A. H. and F. Aghili. 2018. "Evaluation of Lead and Cadmium Concentration of Arak City Soil and Their Non-Cancer Risk Assessment in 2017." RUMS_JOURNAL 17(8):769–80.
- Dehghani firoozabady, Azra, hady Zarei MahmoodAbady, and Mohammad Hassan Ehrampush. 2017. "Investigation on Industrial Waste Waters Reuse of Industrial Towns for Agricultural and Irrigation Uses (Case Study: Treatment Plant of Jahan Abad MeybodIndustrial Town) 16(3):46–55.
- Farhan, Amina F., Kossay K. Al-Ahmady, Abd-Aljabbar Al-Masry, and Dr Nawfal. 2020. "Assessment of Tigris River Water Quality in Mosul for Drinking and Domestic Use by Applying CCME Water Quality Index." MS&E 737(1):12204.
- Feng, Yan, Liu Chenglin, and Wei Bowen. 2019. "Evaluation of Heavy Metal Pollution in the Sediment of Poyang Lake Based on Stochastic Geo-Accumulation Model (SGM)." Science of the Total Environment 659:1–6.
- Hatami, Tayebeh, Azam Nadali, Ghodratollah Roshanaei, and Reza Shokoohi. 2018. "Feasibility of Reuse of Effluent from the Extended Aeration Process of Wastewater Treatment Plant in the Bojnoord City for Agricultural and Irrigation Uses 16(3):20–28.
- Hoang, Hong-Giang, Chitsan Lin, Huu-Tuan Tran, Chow-Feng Chiang, Xuan-Thanh Bui, Nicholas Kiprotich Cheruiyot, Chien-Chuan Shern, and Chia-Wei Lee. 2020. "Heavy Metal Contamination Trends in Surface Water and Sediments of a River in a Highly-Industrialized Region." Environmental Technology & Innovation 20:101043.
- Jaiswal, Maneesh, Jakir Hussain, Sanjay Kumar Gupta, Mahmoud Nasr, and Arvind Kumar Nema. 2019. "Comprehensive Evaluation of Water Quality Status for Entire Stretch of Yamuna River, India." Environmental Monitoring and Assessment 191(4):208.
- Kang, Dong-hwan, Yoon Hwan So, Kyeong-deok Park, Il-kyu Kim, and Byung-Woo Kim. 2019. "Analyses of TOC Efficiency and Correlation between DO, BOD, COD and Influence Factors Using Long-Term Observation Data in the Main Stream of Nakdong River." Journal of Environmental Science International 28(5):465–74.
- Khalili, Reza, Mehrorang Ghaedi, Mohammad Parvinnia, and Mohammad Mehdi Sabzehmeidani. 2021. "Simultaneous Removal of Binary Mixture Dyes Using Mn - Fe Layered Double Hydroxide Coated Chitosan Fibers Prepared by Wet Spinning." Surfaces and Interfaces 100976.
- khalili, reza, Mohammad Parvinnia, and Hamed Motaghi. 2021. "The Effects of Forecasted Precipitation Amount on Probable Maximum Precipitation and Probable Maximum Flood Parameters." Journal of Environmental Science Studies 5(4):2982–89.
- Khalili, Reza, Mohammad Parvinnia, and Abolfazl Zali. 2020. "Water Quality Assessment of Garmarood River Using the National Sanitation Foundation Water Quality Index (NSFWQI), River Pollution Index (RPI) and Weighted Arithmetic Water Quality Index (WAWQI)." Environment and Water Engineering 6(3):274–84.
- Khalili, Reza, Abolfazl Zali, and Hamed Motaghi. 2021. "Evaluating the Heavy Metals in the Water and Sediments of Haraz River, Using Pollution Load Index (PLI) and Geo Accumulation Index (Igeo)." Iranian Journal of Soil and Water Research.
- Li, Yuezhao, Haiyang Chen, and Yanguo Teng. 2020. "Source Apportionment and Source-Oriented Risk Assessment of Heavy Metals in the Sediments of an Urban River-Lake System." Science of The Total Environment 737:140310.
- Manii, Jwad K. and Aqeal A. Al-Zubaidi. 2013. "Assessment of Hydrochemical Water Quality on Al Delmaj Marsh Application of the CCME WQI." Journal of Babylon University/Pure and Applied Sciences 21(1):270–80.
- Prasad, Satish, Ridhi Saluja, Varun Joshi, and J. K. Garg. 2020. "Heavy Metal Pollution in Surface Water of the Upper Ganga River, India: Human Health Risk Assessment." Environmental Monitoring and Assessment 192(11):1–15.
- Şener, Şehnaz, Erhan Şener, and Ayşen Davraz. 2017. "Evaluation of Water Quality Using Water Quality Index (WQI) Method and GIS in Aksu River (SW-Turkey)." Science of the Total Environment 584:131–44.
- Talbi, Hanane and Slimane Kachi. 2019. "Evaluation of Heavy Metal Contamination in Sediments of the Seybouse River, Guelma–Annaba, Algeria." Journal of Water and Land Development 40(1):81–86.
- Wagh, Vasant, Shrikant Mukate, Dipak Panaskar, Uday Sahu, Manesh Aamalawar, Aniket Muley, and Yogesh Lolage. 2019. "Development of CCME WQI Model for the Groundwater Appraisal for Drinking in Basaltic Terrain of Kadava River Basin, Nashik, India."