

Prediction of Longitudinal Dispersion Coefficient in Natural Streams using Soft Computing Techniques

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ABSTRACT

To accurately estimate the longitudinal dispersion coefficient is important and indispensable in river modeling. Many theoretical as well as empirical formulations have been proposed to determine the longitudinal dispersion coefficient, but these have not been put into consideration because of their great error, and as well the complexity of the phenomenon. The main aim followed in the present paper is to investigate the method as well as equations developed for dispersion coefficient estimation and assessment of the accuracy of these methods in comparison with real data and developing an accurate methodology for dispersion coefficient determination making use of such soft computing techniques as, neural, genetic programming and Neuron-Fuzzy Inference System. ANFIS approach ended up with the excellent results of: $R^2 = 0.87$, RMSE = 72.21, CRM = 0.103 and EF=0.75 as compared with the existing predictors of dispersion coefficient. In total ANFIS approach is hereby proposed as a most acceptable technique for estimating the longitudinal dispersion coefficient.

Keywords: Soft computing techniques, Pollution, River, Longitudinal dispersion coefficient.

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Study of the Effect of Discharge and Bed Roughness on the Maximum Solute Diffusion Length in a Parabolic Channel

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Abstract

Diffusion processes of contaminants are important processes in channel because of their effect on environmental pollution and health. In the present research, the effect of different levels of bed roughness coefficient and discharge rate on transverse diffusion coefficient and on the maximum solute diffusion length was studied in a non-rectangle channel. Three levels of bed roughness coefficient of about 0.2, 0.04 and 0.06 along with three levels of discharge of about 5, 10 and 15 L/s were tested: Sodium chloride was used as the soluble tracer. It was injected in to the water at the upstream cross section. In the water tracer concentration as well as the velocity profile were mined at eight cross sections of 3, 4, 5, 6, 7, 8, 9, 9.5 meter from upstream. The results indicated that the values of the transverse diffusion coefficient varied between 0.23 and 0.56 (cm²/s) and diffusion length values ranged from 108 to 170 (m) for different treatments. As regards constant bed roughness coefficient, increasing the value of discharge can increase diffusion length. Therefore, in constant input flow, roughness coefficient is shown to exert subtractive effect on diffusion lengths. The shape of channel affects the velocity profile, and this is why nonlinear equation was considered to calculate transverse mixing coefficient at different levels of bed roughness coefficient and discharge. In addition, an equation was also developed to explain the maximum diffusion length in a parabolic channel.

Keywords: Diffusion process, Transverse diffusion coefficient, Velocity profile, Non-rectangular channel

Comparative Study of Meteorological Indices with Hydrological Indices for Drought Monitoring Using Data Mining Method (Case Study: Arazakuseh Station-Golestan Province)

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ABSTRACT

Meteorological drought, caused by deficit precipitation as compared with the normally expected, leads to hydrological drought, causing reduction in the flow of rivers, and as well, fall of the groundwater level. Several indices have been defined To make the drought quantitative. For example the Standard Precipitation Index (SPI) which is obtained as based upon the monthly precipitation data, and is an indicator of meteorological drought, also Standard Stream flow Index (SSI), which is an indicator of the hydrological drought. Each of these indices is classified into categories with each category indicating a state of some drought severity. The aim followed in this research is a comparative study of the meteorological hydrological drought indices in Araz Kouse station, located in Golestan Province, which is done by using some association rules in data searching. Following calculation and classification of SPI and SSI indices within a 12-month-period, and by defining different scenarios, it was concluded that there is no complete accor found between the meteorological vs hydrological droughts and according to drought situation in earlier periods, stream flow shows different behaviors. Also drought as compared with wet year, affects the stream flow with a lower latency.

Keywords: Meteorological Drought, Hydrological Drought, Data Mining, Association Rules.

Use of developed GP Optimization Tool for Multi-objective Operating of Reservoirs in Climate Change Conditions

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ABSTRACT

The application of optimization methods and tools for multi-objective utilization, in operation of a reservoir in the wake of climate change conditions is an inevitable issue. In this study, Multi-Objective Genetic Programming (MO-GP) is employed to extract multi-objective optimal operating rules from Aidoghmosh reservoir (East Azerbaijan) in climate change conditions. These rules are derived with two objectives of minimization of the vulnerability and maximization of the reliability in the baseline (interval 1987-2000) and climate change (interval 2026-2039) conditions. The results show that the range of changes of the vulnerability index in the baseline vs climate change conditions are from 16 to 41% and from 11 to 35% and the range of changes of the reliability index in the baseline vs climate change conditions are from 46 to 78% and 30 to 77%. In order to do more investigations, the two alternatives (development of rules in the baseline operating interval as based upon the baseline conditions; and rules developed within climate change operating intervals as based upon climate change conditions) are considered. In order to investigate the performance of the reservoir in supplying of the demand, the objective function values for a Pareto point (reliability of 75%) in the two alternatives under consideration are compared. The results show that the second alternative is of a more appropriate performance, relative to the first one.

Keywords: Optimization tools; Climate change; Reliability; Decision rules; Solutions' quality and distribution

Linking Drought Monitoring Systems to Management Measures for Zarrinehrood Dam Operation (Case Study: Zarrinehrood Basin)

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ABSTRACT

Monitoring systems and definition of mitigation actions are two of the main components of every drought management plan. Appropriate link between these two can help the timely and effective implementation of a management program. So, in this study it is attempted to design a probabilistic system as based on the risk to manage the Zarrineh-rood basin. Within this approach, drought alert thresholds are defined in probabilistic terms and based on reservoir storage volume. Short term simulations are carried out using the software package WEAP and four scenarios (normal, pre-alert, alert and emergency) associated with different levels of severity of drought defined. Then threshold values and coefficients of decreasing demand are identified, considering the probability of existence of a certain deficit of demand in a certain time horizon using Genetic Algorithm Optimization Model. These coefficients for crop production, horticulture, and environmental needs were estimated as follows: The coefficients at pre-alert level are equal to 31.30%, 7.30% and 47.8%, at the alert level equal to 33.60%, 9.2% and 50.60% and at the emergency level they amount to 35.5%, 11.10% and 52.20%, respectively. Considering the fact that the coefficients of decreasing demand had a significant impact on the reduction of the indicators of deficit, especially during the crisis period of 1999 to 2001, this resulted in the prevention of the complete emptying of the reservoir during the mentioned period.

Keywords: Probabilistic systems, drought alarm, Drought management, Zarrine Dam, genetic algorithm.

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Application of Joint Deficit Index (JDI) for Analyzing Droughts over the Southern Margin of the Caspian Sea

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ABSTRACT

Drought is a climatic phenomenon that slowly and gradually emerges, and is of a latent nature. It lasts long, damaging the different sectors of agriculture, environment and consequently the society. Monitoring and prediction of droughts, especially accurate determination of their times of emergence, and duration, are very important in water resources management and in planning for drought mitigation strategies. Throughout the present study, drought conditions in three provinces (Golestan, Guilan and Mazandaran) located in the southern margin of the Caspian Sea, were evaluated by means of Joint Deficit Index (JDI). The performance of JDI was compared with two other drought indices, Standardized Precipitation Index (SPI) and Modified Standardized Precipitation Index (SPI^{mod}). To follow the purpose, monthly precipitation data from 5 synoptic stations, namely: Babolsar, Bandareanzali, Ramsar, Rasht and Gorgan during the period of 1971 to 2011 were used for calculating the drought indices. Results showed that in recent years, the number of dry months across the study area had increased, significantly, as for all the considered stations (except Babolsar) the percentage of dry months had increased to more than 50% during the recent 10 years of 2002-2011. Based upon the calculated JDI, SPI and SPI^{mod} values, it becomes evident that the dry condition (along with deficit in precipitation) increase with an increase in the distance from the Caspian Sea. The results also indicate that JDI provides for a comprehensive assessment of droughts and that it is capable of reflecting both emerging and prolonging of the droughts in an accurate manner, allowing for a month-by-month drought assessment.

Keywords: Copula functions; Drought; Caspian Sea; Joint Deficit Index.

Variations of Runoff Generation during Rainfall Event when Different Levels of Polyacrylamide in Its Powder vs Liquid form Applied

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ABSTRACT

A study of the temporal variations in runoff generation is one of the important in water and soil conservation when either under natural conditions or accompanied by application of soil amendments. However, runoff generation variations along with application different types of soil amendments has less been considered. Therefore, the current study was planned to investigate such states of runoff generations' temporal variations as observed on a clay-loamy soil. To follow the purpose, the effects of different levels of Polyacrylamide (0.4, 2, and 6 g m⁻²) on runoff generation in the presence of flour vs liquid types were carried out on 0.25 m²-small plots and as well in lab conditions. Rainfall simulation was performed with two intensities of 50 and 80 mm h⁻¹ for 17 and 8 minutes, respectively, compatible with the dominant conditions of the area, and after 48 hours past from Polyacrylamide application. Results obtained from general linear model verified non-significant effect (P<0.2) of 0.4 g m⁻² treatment (use of flour vs liquid form Polyacrylamide) and the significant effect (p=0.00) of rainfall intensity on runoff generation. In addition, significant effect of Polyacrylamide type at 2 and 6 g m⁻² levels (P<0.04) and also rainfall intensity (p=0.00) on runoff generation was verified. Also, the cross effect of amendment type and rainfall intensity on runoff intensity in the case of 0.4 g m⁻² treatment was evaluated as insignificant (p>0.2), whereas it was found significant for the 2 and 6 g m⁻² treatments (p<0.04).

Keywords: Rainfall simulation, Runoff control, Soil amendments, Soil conservation

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The Effect of Conjunctive Use of Fresh and Saline Water in Sistan Region

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Abstract:

Sistan region located in Southeast, Iran is one of the many places that are badly in need of special policies for water resource management. Conjunctive use of surface plus groundwater is a common way of an integrated water resources management. The aim followed in this study is to evaluate the strategy of conjunction of saline subsurface water with fresh surface water (Hirmand River) in Sistan region. To achieve this, an experiment was performed within a randomized complete block design of five treatments and three replications on sorghum on the experimental field of Zabol University located in Sistan dam area within spring of 2013. The fresh and saline water samples required for the experiment were provided from Hirmand river (EC= 1.2 dS/m) and a well existing on the field (EC= 15 dS/m), respectively. Treatments consisted of; control, irrigated with one-half of salty water, alternation in time, mixed vs completely salty water. The studied traits were comprised of the biological attributes of sorghum as well as salinity changes within the soil profile. The analysis of variance showed that there are significant differences ($p < 0.01$) in dry weight of stem, leaf and aerial organs of the plant, plant height and leaf area index for all the treatments. Following, control the one-half salty treatment, with an increase of 75.8 % in leaf dry weight and 55.3 % in weight of aerial organs (in comparison with the completely salty treatment) presented the most appropriate performance. Also, a comparison of soil profile salinity prior to, and after the experiment showed that all the foresaid treatments caused an increase of salinity in all the soil profile layers (except for 80-100 cm layer for which, the salinity was affected by the water table). The results of yield components and soil profile salinity showed that for the crop sorghum an alternate use of saline and fresh water (alternate time treatment) is more appropriate than a mixing of them. Therefore in such regions as Sistan plain with scarce fresh water, the methods of one-half and alternate time could be employed for irrigation.

Keywords: Conjunctive irrigation, Salinity, Sistan plain, Sorghum, SAS model, SPSS model

Applying System Dynamics Approach for Simulation and Optimization of the Cropping Pattern in Esfahan Right Side Abshar Irrigation and Drainage Network

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ABSTRACT

Integrated operation of water resources in Esfahan Right Side Abshar Irrigation and Drainage Network was studied, applying system dynamics methodology. The network is a critical one of Zayande Rood Basin the ratio of income to expense of which was investigated, considering the two cases of no change in cropping pattern vs change in cropping pattern during 1385-86 base years to obtain the optimal cropping pattern in the region. For an optimization of the cultivation pattern, maximization of the ratio of income to cost was defined as an objective function. The objective function was defined for two different cases of keeping the sum of cultivated areas using different methods of irrigation water management and requiring percent limits of change in cultivated area and in proportion to the base year, applied to each crop within the model. Following statistical analysis and calculation of the Root- Mean-Square Error, standard error, and correlation coefficient, the adjustment between the performances of the assessed vs simulated network products was determined. The values of these product indexes, according to the conditions prevailing on the network, were estimated as 209.98 kg/ha, 0.007, and 0.99, respectively. The results indicated a fair reasonable accuracy. Furthermore, the ratio of income to expense in the network amounted to 3.025 and 3.144 for the two cases of: no change in the cropping pattern vs change in the cropping pattern within the base year. The optimal cropping patterns were obtained through an application of 50% limit of the cultivated area for each crop within the base year. Results finally indicated that the existing cultivated area is very different from the desired one, and the combination of the dominant crops adopted is far from beneficial.

Keywords: Cropping pattern, Income to cost, Integrated Use, Optimization, Surface and Ground water resources.

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Effect of Water and Salinity Stress on Evapotranspiration and Growth of *Barhee* Juvenile Date Palms

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ABSTRACT

Irrigation water availability could be enhanced through suitable use of water in agriculture as by use of saline, and reuse of drainage waters. This factorial experiment was carried out as based upon a randomized complete design of three replications for an investigation of water and salinity stress effects on *Barhee* juvenile date palm evapotranspiration and growth. The treatments were three irrigation depths of 100%, 85% and 70% water requirement and three irrigation water salinities of 2.5, 8 and 12 dS/m. The results revealed that irrigation depth, water salinity and interaction of irrigation depth and water salinity had significantly affected soil salinity and plant evapotranspiration. The maximum and minimum plant evapotranspiration rates were recorded 1488.9 and 861 mm in water salinity state of 2.5 dS/m with an irrigation depth of 100% vs water salinity of 12 dS/m with irrigation depth of 70% water requirement, respectively. The salinity stress decreased juvenile date palms, evapotranspiration more than water stress did. The irrigation depth, irrigation water salinity and interaction of irrigation depth and irrigation water salinity significantly affected all the plant's vegetative characters. The highest plant vegetative growth obtained from water salinity of 2.5 dS/m and irrigation depth of 100%, but not significantly different from the case of irrigation depth of 85% with respect to vegetative characters. Therefore, irrigation depth of *Barhee* juvenile date palms can be reduced, but care must be taken to avoid plant's salinity stress.

Keywords: Irrigation, Drain water, Lysimeter, Vegetative growth

Evaluation of AquaCrop vs SALTMED Models to Estimate Crop Yield and Soil Salinity

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ABSTRACT

Application of simulation models is a strategy in agricultural water usage management and in predicting the effect of saline water on crop yield and as well on soil salinity. Recently, FAO has introduced a new version of AquaCrop model through which one can calculate the effect of irrigation water salinity on crop yield and on soil salinity. In the present study, AquaCrop and SALTMED models were evaluated under alternate application of saline vs fresh water for maize as a forage crop. The required field experiments were carried out in nine treatments (under different conditions of using non-saline vs saline water) in Karaj region. In SALTMED model, R^2 values were obtained 0.843 and 0.733 for soil salinity and crop yield, respectively, while these values amounted to 0.758 and 0.846 respectively, for AquaCrop model. Relative error in AquaCrop model varied between 2.9 and 30.8% in crop yield estimation and between 5.9 and 45.8% in soil salinity estimation. The relative error in SALTMED model ranged from 0.9 to 24.7% to estimate crop yield while ranging from -2.2 to 38.2% in estimation of soil salinity.

Keywords: Simulation, Cyclic use of saline water, Drip irrigation, forage maize

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Performance Evaluation of Organic and Mineral Development of Drainage Pipes, In Circumstances Similar to Those of Paddy Fields

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ABSTRACT

Envelopment of drains improves hydraulic conductivity, by preventing the excessive small soil Particles from entering the pipes. Throughout the present study the performances of organic (rice husk), envelope, mineral envelope, as well as mixed envelope, comprised of rice husk and minerals, on the trend of hydraulic traits and chemical changes of the drain water was investigated. Towards this end, the physical model of the drainage system including pipe drains with diameters of 10 cm were buried under 37 cm of soil and then covered with a 7 cm transect of enveloping material as according to the envelope treatments. The experimental boxes were filled with soil of similar texture to those of the paddy fields in Guilan province (silt loam). Irrigation was so applied that a depth of 5 cm of irrigation water stood on the soil. Long term flow test was conducted under 1.9 dS/m of Electro conductivity for 500 hours of drainage flow. Salinity, Sodium Absorption Ratio, pH and TSS were recorded. The experimental treatments of envelopment were noted as the rice husk (H), Sand (G), a mixture of 80 percent sand and 20 percent rice husk (H20G80), A mix of 60 percent rice bran and 40 percent sand (H60G40), the mixture of 80 percent sand and 20 percent rice husk (H80G20), the mixture of 60 percent sand and 40 percent of rice husk (H40G60) as well as one with no envelope (B) taken as the blank. The results revealed that the discharge of the sample treated with H was more than that of G, treated and was reduced by decrease in rice husk depth in the mixed envelopes. H60G40 exhibited H80G20 exhibited lower EC means in their drain water, presenting more appropriate performances in their salinity control Treatments H and H80G20 performed well in decreasing TSS in their drain pipes.

Keywords: Silt Loam Texture, Physical model of drain, Drainage water quality, Sand, Rice Husk.

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Phosphate Removal from Karun Agro-Industry INC Agricultural Wastewater through Vetiver planation, and within Free Water Surface Constructed Wetland

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ABSTRACT

To investigate the performance of artificially constructed wetland in phosphate removal from agricultural wastewater, free water surface constructed wetlands were employed. Nine rectangular pools were constructed and operated continuously from December 2013 until May 2014. Three of the units were filled with soil and planted with vetiver transplants (S), three were cultivated with vetiver on some floating platforms (F) and three kept non-planted as control (C). The study was divided into 6 phases, each of a 6 month, period, using three HRTs (3, 5 and 7 days). Concentration of phosphate was evaluated at the inlet vs outlet of the system, and the data analyzed, using SAS, to find out the significance between or among factors. The average phosphate concentration, in the wastewater entering the unit was recorded 5.99-8.58 mg/L. The results indicated that the phosphate removal performance of the constructed wetland units differed significantly ($P < 0.05$) correct. The average removal rates being different for any of the: cultivation method, HRT, and temperature treatments. The units that contained soil substrate(S) presented the most appropriate in performance removal, the efficiency of which was 9.46–35.48%. The removal rates were also positively correlated with HRT, since the performance for phosphate removal was on the average 8.88-35.48% for 7days of HRT. In addition, it was shown that there existed a significant difference ($P < 0.05$) in phosphate removal between different months in most units. The results finally indicated that the average phosphate removal rate was significantly affected by temperature variations, CW and HRT. The highest phosphate removal efficiency (average 35.48%) occurred in May, when kept for 7 days, and when under soil substrate medium.

Keywords: Eutrophication, Phytoremediation, Vetiver

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Determination the Constant Parameters of Van Genuchten-Mualem and Gardner's Equations Using a Statistical Model to Estimate the Permeability in Unsaturated Soil

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ABSTRACT

Availability of accurate information regarding permeability of soil is needed in planning for the development projects, especially hydraulic structures. Laboratory determination of unsaturated permeability of soil involves high costs and is very time taking. Therefore, it is preferred to determine it using such indirect methods as making use of soil-water characteristic curve. These indirect methods are of constant parameters the determination of which needs such special information of soil water characteristic curve as residual and saturated water contents. Through initially examining a statistical model (not a function of residual and saturated water contents) the permeability coefficients of unsaturated soil that were in acceptable correlation with famous models were determined. The constant parameters of some of the equations for estimation of the permeability of unsaturated soil were then estimated. The results finally show a high accuracy of the proposed model for a determination of the constant parameters.

Keywords: Residual Water Content, Soil Water Characteristic Curve, Correlation Coefficient, RETC, RMSE

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Investigating Various Spectral Resolution Scenarios on Predicting Soil Hydraulic Properties

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ABSTRACT

Pedotransfer functions (PTFs) have been developed to indirectly predict soil hydraulic properties (SHPs) from easily measurable soil properties mainly including textural properties, soil organic matter and bulk density. In the last few decades, several studies have addressed the potential of soil spectral information in visible, near-infrared (350-2500 nm), to provide predictors to estimate elementary soil properties. Predicting SHPs by soil spectral data is a new approach that has not yet been explored. In this study, the feasibility to estimate the Mualem-van Genuchten (MvG) hydraulic parameters was investigated using Spectro Transfer Functions (STFs). Four scenarios of data affrication namely: ASD full spectrum (scenario I), EnMAP (scenario II), Sentinel-2 (scenario III) satellite-based spectral resolution and laboratory and soil map-based Rosetta and HYPRESPTFs (scenario IV) were investigated. A Stepwise Multiple Linear Regression (SMLR) coupled with bootstrap method was employed to derive STFs. The most appropriate results for predicting MvG parameters were obtained for scenarios *I* and *II*. Compared with scenario IV, all the other three spectral scenarios performed reasonably well in terms of predicting soil water retention characteristics and unsaturated hydraulic conductivity. These findings suggest that spectral reflectance data at various spectral resolution levels is a promising indirect and quick method for large scale soil hydraulic parameter estimations.

Keywords: spectral reflectance; pedotransfer functions; spectrotransfer functions; soil water characteristics curve; Mualem-van Genuchten

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Characteristics of Nitrate Sorption onto Activated Carbon

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ABSTRACT

The potential of activated carbon (a product of Merck) as an adsorbent has been studied for removal of nitrate from some polluted water sources. In line with this purpose, nitrate sorption kinetics and isotherms, as well as the effects of contact time, initial concentration, pH and temperature on nitrate sorption onto activated carbon were investigated. The surface characteristics of activated carbon were also studied, through FTIR and SEM techniques. Two simplified kinetics models, namely: pseudo-first and pseudo-second orders were tested to investigate the sorption mechanisms and while two isotherm models namely Freundlich and Langmuir employed to describe the equilibrium sorption of nitrate onto activated carbon. The results revealed that the amount of nitrate sorption increased with time and reached its maximum after ten minutes past. Maximum nitrate sorption occurred in a neutral pH figure, and with either increase or decrease in the pH level, the amount of sorption being decreased. The amount of nitrate sorption increased with a decrease in temperature, level, depicting the exothermic nature of sorption. A comparison of the coefficient of determination of the fitted equations indicated that pseudo-second order equation ($R^2=1.000$) was better fitting than pseudo-first order equation ($R^2=0.839$) for description of nitrate sorption data. Sorption isotherm was proper, as described by Langmuir model ($R^2=0.998$) and the maximum sorption parameter equaled 8.93 mg per gr of activated carbon.

Keywords: activated carbon, isotherm, kinetics, nitrate, sorption.

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Effect of Three Successive Years of Fire on Some Physicochemical Properties of a Forest Soil around Zarivar Lake in Marivan

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ABSTRACT

The present study was conducted to investigate the effects of three successive years of fire burning on some physicochemical properties of surface (0-5 cm) and subsurface soil (5-10 cm) in Tappeh Darvish forest located in the surroundings of Zarivar Lake, Marivan. A control with similar conditions, but not affected by fire was selected in the vicinity of the fire burned area. Three composite soil samples were taken from the mentioned depths in the burned site and from control site. The samples were analyzed for texture, EC, pH, T.O.C, T.N, N_{ava} (NO_3^- and NH_4^+), P_{ava} , K_{ava} , Ca_{ava} , Mg_{ava} , Cation Exchangeable Capacity (CEC) and Total Neutralizing Value (TNV) contents using standard methods. The results showed that, in general, changes in the soil properties following fire were greatest at the subsurface soil and more modest at the subsurface soils. Soil TNV and EC content changed notably, following fire, with higher values in burned soils. Nitrogen, potassium, phosphorus, calcium and magnesium became more available following fire, while CEC levels were found to be unchanged in the burned soil in comparison with the unburned soil. Soil pH, total C and N content slightly increased in the burned soil. Furthermore, the soil texture became lighter following fire with a lower content of clay in the burned soils. In total, it was concluded that fire significantly affects soil physicochemical properties and reduces the quality of soil as in forestlands.

Keywords: Forest soil, Marivan, Soil physicochemical properties, Successive fire

Effects of Organic Matter on the Kinetics of P fixation in Different Type Soils

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ABSTRACT

Effects of Organic Matter (OM) on the kinetics of P fixation were studied on four types of soil treated with different levels of cow manure and incubated for two months before being treated with K_2HPO_4 at the rate of 45 mg P/kg, and then incubated for a period of 100 days at 25°C. Samples were taken from the soils at within intervals of 0, 1, 5, 20, 50 and 100 days and then their Olsen-P determined. It was revealed that the rate of oxidation of OM and the amount of organic-P mineralized were negatively correlated with the clay fraction content of the soil. The rate of oxidation was also increased with increase in the amount of OM added to the soils. The P associated with the manure was of a higher availability than the P in the mineral fertilizer. Kinetics of P fixation in the presence of OM was influenced by the mineralization of P especially at shorter incubation times, and the net effects of adsorption, precipitation, immobilization and mineralization processes occurring during the incubation, determined the amount of Olsen-P at any time. Addition of OM to the soils caused an increase in the recovery of applied P, the effect being more pronounced at longer incubation times.

Keywords: Mineralization, Organic carbon, Kinetics, Organic phosphorus, P-Fixation

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The Effect of Nano vs Micro Iron Oxide on Phosphorus Availability and Fractionation in Calcareous Soils

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ABSTRACT

Phosphorus exhibits complex chemical behavior in response to such various soil factors as iron oxide. The effect of size and concentration of iron oxide particles on different forms of phosphorous in soil as well as its availability to plants was investigated. The study was conducted in the form of a factorial arranged experiment based upon a completely randomized design of four replications along with five levels of bulk iron oxide vs nano iron oxide (0, 500, 1000, 5000, 10000 mgkg⁻¹). The results revealed that the use of iron oxide nanoparticles in all the samples reduced Olsen P concentration. The concentration was reduced from 3 mgkg⁻¹ in bulk sample to 0.9 mgkg⁻¹ in 5000 mgkg⁻¹ nanoparticle sample, while this effect was not observed in the case of bulk iron oxide. A significant variation in Ca₂-P, Ca₈-P concentration was observed with changes in size and concentration of iron oxide, especially in Nano treatments. The changes in Ca₁₀-P levels in the case of nano treatments were greater than those in bulk treatments, but not statistically significant. Iron oxide concentration significantly affected the level of Fe-P form. O-P form showed significant difference (compared with blank) only in the case of 10000 mgkg⁻¹ of nano iron oxide.

Keywords: Calcium Phosphate, Inorganic phosphorus, Iron Phosphate, Occluded Phosphorus

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Quantitative and Qualitative Evaluation of Auxin (IAA) Production Potential of Cyanobacteria, Isolated from Guilan Paddy Fields

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ABSTRACT

Cyanobacteria represent a less investigated group of prokaryotes, in terms of their effect on plant growth, especially in relation with the production of phytohormones. The present research was aimed at evaluating Indole Acetic Acid (IAA) production potential of cyanobacteria strains isolated from Guilan paddy fields through the two quantitative and qualitative methods, their potential being determined in terms of rice seed germination indices. The results obtained indicated that some cyanobacteria isolates could produce auxin hormone IAA. GGuCy-34 and GGuCy-42 isolates respectively produced 14.98 and 10.83 [$\mu\text{g IAA}/(\text{ml. Chl. } a)$] in no L-Trp treatment, GGuCy-34, GGuCy-15 and GGuCy-42 isolates respectively produced 23.7, 17.46 and 15.81 [$\mu\text{g IAA}/(\text{ml. Chl. } a)$] in 100 (mg L-Trp/ml) treatment and GGuCy-15 and GGuCy-16 isolates respectively produced 29.16 and 21.61 [$\mu\text{g IAA}/(\text{ml. Chl. } a)$] in 500 (mg L-Trp/ml) treatment. The results finally revealed that IAA production is highly correlated with the type of isolate and as well with the culture medium. Germination energy and germination rates increased in the cases of GGuCy-25, GGuCy-42, GGuCy-41, GGuCy-26 and GGuCy-50 isolates, and while dry radical weight as well as dry plumule weight increased in the cases of GGuCy-42, GGuCy-50, GGuCy-25 isolates.

Keywords: IAA, Rice, Tryptophan, Germination, Cyanobacteria