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EFFECT OF CRUDE OIL ON SOIL PROPERTIES AND UPTAKE OF MAJOR ELEMENTS BY LENTIL (*LENS EXCULENTA*) AND PEA (*PISUM SATIVUM)*

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Abstract

Contamination with crude oil can have adverse effects on environment and human. Plants uptake of chemicals from contaminated soils increased due to volatilization or bioaccumulation or even biodegradation. Plants consumption pathway in both environment and human health. After planting lentil and pea in same conditions, the results show the effect of contaminant soil with crude oil on some parameters of soil and plants. The contaminated soil with crude oil affected on pH, humidity and potassium availability. Soil parameters, the results show significant in pH, humidity and potassium as (0.003, 0.008, 0.047) respectively and after crude oil contaminated soil pH and humidity shows significance as (0.037, 0.038) respectively. Contaminated soil with crude oil affected on the length of the plant and dry weight and protein content. Lentil showed a significance in the length and dry weight at level 5% as (0.029) and dry weight at level 5% as (0.024), Pea registered significant results in protein content as (0.019) and plant length as (0.007).

Key words **:** Crude Oil, Contaminant Soil, Lentil, Pea, Plant Uptake.

Introduction

Plants are the most important component of the earth's biomass due to photosynthesis operation. Plants are the base of all food webs (Doucette *et al.*, 2018). Different chemical contaminants can directly contact and accumulate in the plant tissues. The movement and distribution of the contaminants within the plant are determined by the properties of contaminants and plants (Zaki *et al*., 2017). Legumes are the most demanding crops grown and consumed by humans because of their high nutritional value and contain a range of nutrients and various mineral elements. Lentil crop is a cheap and rich source of protein. The productivity can be increased by selecting suitable higher dry matter production. Dry mass is largely determined by the degree of competition for assimilates between vegetative and reproductive sink (Mondal *et al.*, 2014). Peas are starchy, but high content of fibers and other minerals and have greater ability to chelate metals and inhibit linoleic acid oxidation. It considered as a cool season crop, seeds may planted even if the soil temperature reach 10^{o}C (Zaki *et al.*, 2017).

Crude oil formed long time ago from organic materials, once extracted it can be processed into a wide range of products which all contain chemical compositions. Crude oil and its products contain a mixture of petroleum hydrocarbon (PHC) and non-hydrocarbon compounds (Kvenvolden, 2006). Polycyclic aromatic hydrocarbons (PAH) are a constituent of crude oil can cause cancer or mutation which effects human and animals (Moubasher *et al.*, 2015). Thus petroleum contamination is critical for human and environment. These exposure pathways must be evaluated based on site conditions to determine whether the soil is contaminated or not which might be source of environmental risk on human (Hunt *et al.*, 2019).

Organic chemical contaminants such crude oil can transferred through the roots into above ground plant tissue like stems and leaves (Doucette *et al.*, 2018). It can moved or distributed depends on the plant and associated microorganisms (rhizobium or another organisms). These organisms with its relation with plant could transferred the contaminants into terrestrial plants. This mechanism are important to evaluating the environmental and assessing human risks, also predicting phytoremediation effectiveness (Wetzel and Doucette, 2015). Gas exchange

and deposition were the way of contact of organic contaminants with aboveground vegetation at leaf surfaces. The dominant pathways depends on the contaminants properties and leaf cuticle conflict with environment conditions (Barber *et al.*, 2004). Metabolized the organic chemical contaminants may occur during transport, or sequestered within different tissue of plant and may volatilized from surface of plant (Takaki *et al*., 2014). Variability in plant bioaccumulation of chemicals were associated with wide variety of experimental approach used to assess the plant uptake. Even the objectives are different from study to another. Environmental conditions also affect the results like temperature, light and humidity. Plant growth affect the parameters measured (Fantke *et al.*, 2016). The objective of this study is to measuring some parameters to quantify the crude oil effect on lentil and pea, including plant uptake of major elements assess the relationship between plant bioaccumulation and it's properties. Provide preliminary direction for future studies for organic chemicals bioaccumulation in crop plants.

Materials and Methods

The following apparatus were used to complete the instrumental analysis:

i. microwave oven of RE 1000 type

ii. A spectrophotometer with autosampler and cuvete

iii. pH meter

iv. Oven

Sample Procedure and Preparation

Soil were two types and plant samples were (*Lens exculenta*, *Pisum sativum*) collected from three sites from 1\10\2018 to 1\4\2019. Totally 84 sample from soil and 96 sample from plant. The soil samples were dried at lab temperature for 7 days and sieved (2mm sieve). The assessing method were made for soil pH, EC, N, P, K (Chavan *et al.*, 2018). Samples of plants were dried for 14 days. The samples were microwave digested to determine the Hydrocarbons in leafs (Protein), N (Nitrogen), P (phosphorus), K (Potassium), Plant Length, Leaf area, dry weight (Verma *et al.*, 2018). All results obtained (3 repetition) were statistically analyzed and calculated. The differences between mean value were compared by least significant 5%.

Table 1: Some soil properties which not contaminated with crude oil.

	Lentil	Pea
pH	6.96	7.13
Hum	50.66	50.00
CHO	44.00	44.00
EC	6.03	5.73
N	3.33	3.06
P	11.53	12.06
K	4.60	5.56

Table 2: Some soil properties which contaminated with crude oil.

	Lentil	Pea
pH	7.96	8.06
Hum	43.33	51.66
CHO	48.00	45.33
EC	5.90	5.86
N	3.40	3.20
P	11.66	12.33
K	5.13	5.70

Results and Discussion

From table 1, the result showed content of planted soil whit lentil and Pea without treatment by oil. The value of parameters reached (6.96, 7.13), (50.66, 50), (44, 44), (6.03, 5.73), (3.33, 3.06), (11.53, 12.06), (4.06, 5.56) for pH, Hum, CHO, N, P and K respectively. Cultivation of plants in the soil probably led to nutrient uptake by plants and thus lower soil level.

Result from table 2, shows means of content of some soil properties after contamination of crude oil. The value of all parameters. A slight difference in values was recorded in the soil properties compared to the soil that was not polluted with oil. The values reached (7.96, 8.06/pH), (43.33, 51.66/Hum), (48, 45.33/COH), (5.9, 5.86/EC), (3.4, 3.20/N), (11.66, 12.33/P) and (5.13, 5.7/K) in planted soil with lentil and pea sequentially.

With regard to plant which planted in soil without crude oil the result indicated that, chlorophyll, length plant, leaf area and dry weight reached (1.80, 1,96), (13, 14), (12.13, 1.03) and (11.02, 14.34) while N, P and K recorded (4.93, 4.40), (2.3, 3.6) and (4.7, 4.63) in planted soil with lentil and pea respectively.

Table 4, showed the some vegetative characteristics and the content of elements of lentil and pea in cultivated

Table 3: Some properties of plants which planted in soil contamination without crude oil.

	Lentil	Pea
CHO (Protein)	2.30	3.60
N	4.93	4.40
P	3.53	3.26
K	4.70	4.63
Chlorophyll	1.8	1.96
Length	13.00	14.00
Leaf Area	12.13	1.03
Dry Weight	11.02	14.34

Table 4: Some properties of plants which planted in soil contamination with crude oil.

	Lentil	Pea
CHO (Protein)	2.63	2.48
N	4.90	3.58
P	4.20	2.80
K	4.55	4.18
Chlorophyll	1.9	2
Length	6.23	7.00
Leaf Area	7.54	0.86
Dry Weight	10.83	14.19

soil contaminated with crude oil. The means of chlorophyll, length plant, leaf area and dry weight reached (1.9, 2), (6.23, 7), (7.54, 0.86) and (10.83, 14.19) while N, P and K recorded (4.9, 3.58), (4.2, 2.8) and (4.55, 4.18) in planted soil with lentil and pea respectively.

The study by Mustafa *et al*., (2006) showed that the heavy metals contents remained at normal levels in the plants structure. However, plants growing in polluted environment can accumulate metals at high concentrations, through heavy metal uptake by the plants grown in polluted soil. Previous studies by (Lynchburg, 2000, Sedlak, 2005, Pauline *et al*., 2008). Found out that using doses of polluted increase the accumulation of heavy, thus there was increase in the accumulation of heavy metals in the soil and parts of the plant accordingly. These results are in agreement with studies by Assadin *et al*., (1998) and Vazquez-Montiel *et al.,* (1999), which found that, industrial polluted helps in the reduction of the accumulation of heavy metals in the soil and plants. This result can be explained on the basis of the fact that, different sources of elements depended on the different sources of polluted. Analysis of polluted in this study and other studies by Divya *et al*., (2012) showed increase in the concentration of metals in the oil sources. Also the increases of heavy metals accumulated in the irrigated soil may be ensured the availability of metals in the plant cultivated in contaminated soil. Abagale *et al.,* (2013) reported that the average of heavy metal concentration in car wash wastewater (Oil and Grease) was above the recommended limit of WHO environmental release level. Also the watering of plants with car wash effluent which content Oil and Grease, as is being currently practiced poses health risk as a result of bio-accumulation as well as direct negative on the growth performance of the plants.

Conclusions

The remaining impact of crude oil is adversely affected through uptake by plant, crude oil accumulation in soil and plant can have recorded negative impact on soil properties and plant.

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