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Experimental study to evaluate the environmental impacts of disposed produced water on the surrounding ecosystems

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Abstract

The large volume and high salinity of produced water (PW) could pose severe environmental impacts. This paper presents the laboratory results on PW from G oil field, located in North Africa, and on groundwater samples from nearby freshwater wells, in order to best comprehend the chemical composition of PW and to evaluate their potential impact on the surrounding environment of this oil field. Such a sizeable data set can make it difficult to integrate, interpret and represent the results. Thus, multivariate statistical techniques were used in the usefulness evaluation of geochemical groundwater control process classification and identification. Principal component analysis of produced water identified three components: the first being a salinization factor that accounted for 53.6% of the overall variance; the second accounted for 24.3% of overall variance and was mostly dictated by scale forming potential; and the third component (12.3% of total variance) representing the qu... of the water formed by the rock water interaction. The aforementioned components demonstrate... the quality of discharged produced water didn't meet national or international standards. For t...

groundwater analysis, two principal components/clusters were identified. The first one (69.6% of total variance) represented the hardness and salinity of the water, and the second one (18.4% of total variance) can be regarded as the overall effect of weathering and interactions between water and rock on the groundwater quality factor in general. The analysis did not show any contamination in groundwater at the G oil field and in the nearby farms water wells.

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Abbreviations

BAT:

Best available techniques

BTEX:

Benzene, toluene, ethylbenzene, xylene

BOPD:

Barrel oil per day

BWPD:

Barrel water per day

Br:

Bromine

Cl^- :

Chloride

CO_2 :

Carbon dioxide

Ca^{2+} :

Calcium

Cd^2 :

Cadmium

EU:

European Union

EC:

Electrical conductivity

EGA:

Environmental general authority

HCO_3^- :

Bicarbonates

K^- :

Potassium

Mg^{2+} :

Magnesium

M:

Thousand

Na^{+} :

Sodium

OIW:

Oil in water

Pd:

Lead

PW:

Produced water

SO_4^{2-} :

Sulphates

Sr:

Strontium

TDS:

Total dissolved solid

TOC:

Total organic carbon

TPH:

Total petroleum hydrocarbon

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Ethics declarations

Conflict of interest

The authors declare no conflict of interest.

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- **Fig. 5**

- **Fig. 6**

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