

# Water treatment processes applied at the deoiling stations at Hassi Messaoud (efficiency and professional risks)

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## ABSTRACT

As part of the implementation of the policy of environmental protection, SONATRACH has set up a deoiling station in each producing center to ensure the recovery of hydrocarbons and the production of water reinjection on the basis of a conventional schema comprising three treatment techniques namely: coagulation, flocculation and decantation. In order to improve the efficiency of the established process, new coagulants have been prepared and tested to evaluate their effects on the schema of treatment. Knowing that a number of professional risks have been identified. Our research work also aims at improving working conditions through measures that the company must take into consideration to preserve the health of workers.

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## Introduction

The petroleum industry is the most important sector of development in the economy of our country. However; it generates large quantities of oily water laden with pollutants inducing adverse effects on man and on the environment. For environmental reasons, the SONATRACH group has set up three deoiling stations installed as follows: CIS, UTBS and CINA.

These stations treat all of the oily water from field production stations and the oily raw processing units, compression unit and purges storage bins at level of each industrial center on the Hassi Messaoud region, ensuring the recovery of oil contained in the water charge and the development of recovered water for reinjection [1]. The characteristics of the water of reinjection must be below 10 mg/L for the content of hydrocarbons, of 30 mg/L for suspended solids and a pH between 6.9 and 7.5 [2 – 4].

Through this work we have tried to make a practical contribution to the improvement of the treatment process by the development of new coagulants and the verification of their effects on the treatment regimen.

Particular attention has been given to the professional risks associated with these activities with a view to preserving workers' health.

## Materials and methods

### Materials

The pH of the water is determined using a HANNA pH meter. Suspended solids and hydrocarbon levels are measured using a DR-2000 spectrophotometer.

### Preparation of coagulants

The wastewater treatment technology schema applied at the station (Fig. 1) shows that the removal of hydrocarbons and suspended solids is carried out at the CPI tank. The fine particles are separated by coagulation and flocculation. The oil is recovered by the MS-126 rotary disk deoiler and then sent to the oil tank S-108 by the pumps p-104 A / B. The solids regenerated as sludge are dewatered and buried in impervious trenches [5 – 8].

In this study, the coagulants prepared by mixing sodium silicate and sulfuric acid were injected at different doses in order to test their effects on the treatment schema using Kurifix as flocculant.

The domains investigated in this research are:

- Mass concentration of sodium silicate : 1 – 5 %.
- Mass concentration of sulfuric acid : 1 – 3 %.
- Doses of coagulants per liter of treated water : 3 – 40 mL

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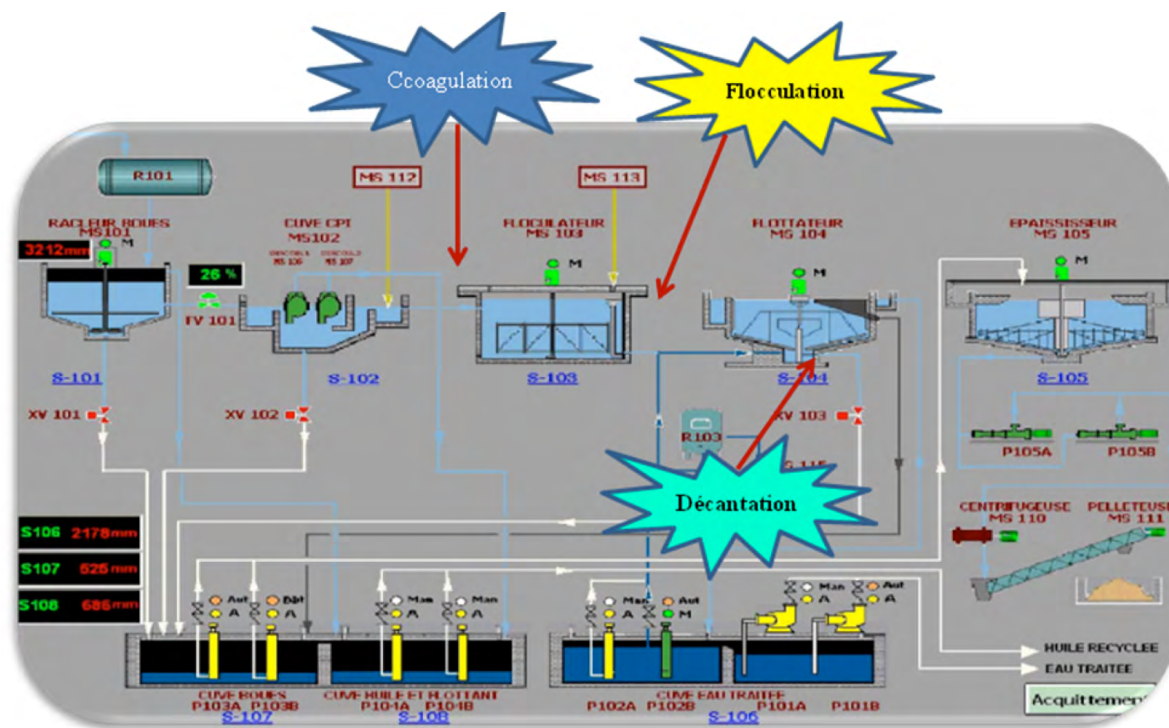


Fig. 1. Technological schema of deoiling station [9].

## Results and discussions

### Characterization of wastewater

The wastewater treated at the different stations is characterized by a slightly acidic pH, an important turbidity and a high suspended matter and oil content as shown in Table below.

Table 1. Characteristics of wastewater treated in Deoiling stations.

pH	5.47
Suspended matter (mg/L)	342.5
Oil (mg/L)	231.5
Turbidity (NTU)	464.5

### Optimization of the treatment process

Due to the impossibility of presenting in a single article the results of the analyzes obtained for each coagulating dose prepared, we are content to present the results of the treatment corresponding to the use of the best prepared coagulant.

Through the analysis of the effect of each dose of coagulants injected, it is noted that the treatment efficiency increases in direct direction with the amount of coagulant. The best treatment results are obtained when using the coagulant prepared by :

- 5% of sodium silicate.
- 2% sulfuric acid.

The injection of a quantity of coagulant corresponding to 16 mL per liter of water produces positive effects on all the studied parameters (Fig. 2).

This treatment ensures:

- An increase in pH of 20.19 % ;
- A reduction in the suspended matter rate of 91.18 % ;

- A reduction in the oil content of 81.68 % ;
- A reduction in the turbidity of 89.86 %.

Despite the results obtained, the application of the prepared coagulant remains insufficient to meet the environmental requirements imposed by the SONATRACH group. Therefore we propose the introduction of a water filtration system after the operation of decantation.

### Effect of the introduction of filtration system in the process

The water decanted after treatment with coagulant is filtered through a Whatman filter. The Table 2 displays the results of the water analysis.

Table 2. Characteristics of filtered water.

pH	6.57
Suspended matter (mg/L)	5.75
Oil (mg/L)	3.50
Turbidity (NTU)	3.18

We notice that the filtration system applied at the end of treatment is able to normalize all the studied parameters and consequently achieve the objectives fixed by the company.

### Professional risks

The probable occupational hazards at deoiling stations that can cause accidents are caused by :

- Lack of knowledge of the process;
- Lack of control over the formulation of raw materials;
- Incorrect loading of reagents;
- Unsuitable feed rates of reagents;
- The wrong order of introduction of reagents;
- Imperfect and / or unregulated maintenance;
- Individual human errors

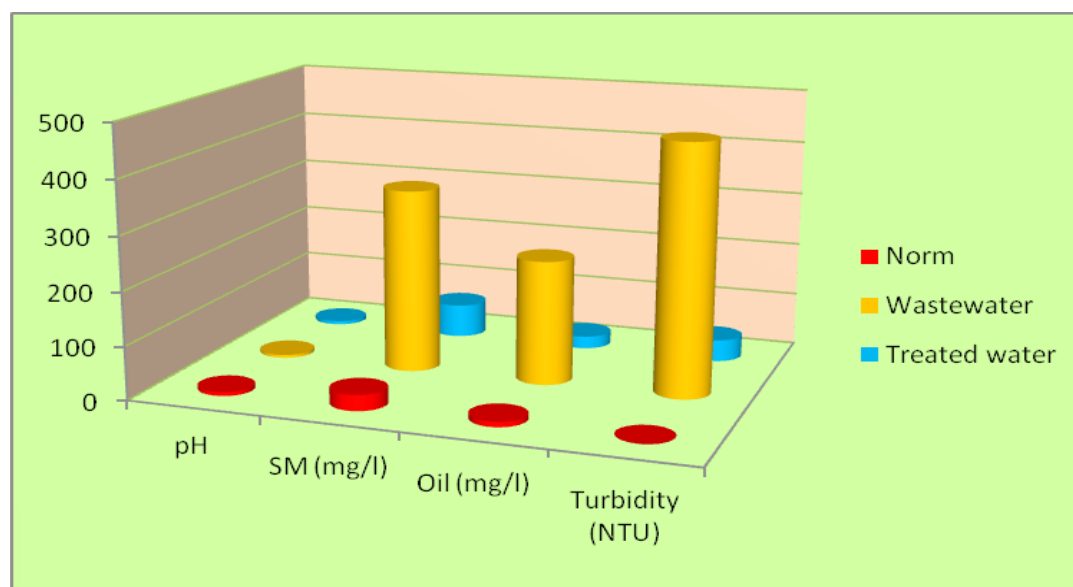


Fig. 2. Effects of proposed treatment on the characteristics of treated water

## Conclusion

At the end of this work, we can cite the following conclusions:

- For each coagulant, the treatment efficiency increases in direct direction with the dose used;
- The use of activated silicate mixed with sulfuric acid as coagulant and Kurifix as flocculant gives promising results in terms of treatment;
- The introduction of the filtration system in the station helps to normalize all the parameters;
- The application of the proposed conditions makes it possible to meet the environmental requirements imposed by the SONATRACH group and to use treated water in reinjection.
- The HSE manager should pay attention to all planned activities at the deoiling station, the laboratory and the chemical storage locals.

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## Conflicts of interest

Authors declare no conflict of interests.

## Notes

The authors declare no competing financial interest.

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