

Optimization of hydrocarbons biodegradation by bacterial strains isolated from wastewaters in Ouagadougou, Burkina Faso: Case study of SAE 40/50 used oils and diesel

Adama Sawadogo, Harmonie C. Otoïdobia, Alfred S. Traoré and dayéri Dianou, Research Center for Biological, Alimentary and Nutritional Sciences and CNRST-IRSS

INTRODUCTION

The utilization of lubricant leads to the production of used oils commonly in the whole world. Used oils and diesel devastate the soil, surface and underground water and alter the microbial population at the polluted sites. Spillage of used oils and diesel oil also contaminates our natural environment with polycyclic aromatic hydrocarbons (PAHs) which attract public attention because many PAHs are toxic, mutagenic and carcinogenic. Fortunately, bioremediation of these hydrocarbons in the environment is possible and exploits the metabolic properties of microorganisms (bacteria, yeast or fungi) to degrade these contaminating agents. The intensity of oils biodegradation is influenced by several factors, such as nutrients, oxygen, pH, composition, concentration and bioavailability of the contaminants, chemical and physical characteristics and the pollution history of the contaminated environment.

OBJECTIVE

The present work focused on the optimization of these hydrocarbons biodegradation using nutrient factors (yeast extract, peptone or trace elements) and surfactants (Tween 80 or SDS), respectively.

METHODOLOGY

Bacterial strains: S2 and S7 isolated during our previous work from waste waters

Hydrocarbons : Diesel oil was purchased from a local oil filling station, SEA 40 and SAE 50 were collected from a local garage.

Culture media: Bushnell-Haas Broth supplemented with 3% (v/v) of 0.22 µm pore size filter-sterilized hydrocarbon

Incubation condition: pH 8, 7.75, 7.5, 37°C during 14, 28, 42 or 56 days. BH+hydrocarbon+10% inoculum (S2, S7 or S2+S7) + 0.5% (w/v) yeast extract, peptone or SDS, 0.5% (v/v) Tween 80 or 1% (v/v) trace elements.

Biodegradation study: Hydrocarbon degradation was studied by gravimetric analysis

MAIN RESULTS

Effects of nutrient factors on Diesel, SAE40 and SAE 50 used oil biodegradation

After 14 days incubation period at 37°C, the biodegradation rates obtained on SAE 50, SAE40 and diesel supplemented with nutrient factors are presented in figures 1 (a, b and c).

Effects of surfactants on Diesel, SAE40 and SAE 50 used oil biodegradation

After 14 days incubation period at 37°C, the biodegradation rates obtained on SAE 50, SAE40 and diesel supplemented with are presented in table 1.

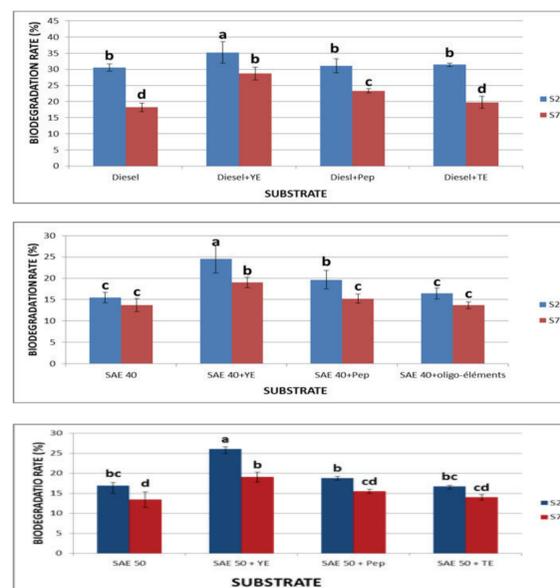


Figure 1: Biodegradation of hydrocarbons supplemented or not with nutrient factors. YE: Yeast Extract, Pep: Peptone and TE: Trace Elements

Substrate	Strain	Biodegradation (%)
Diesel oil	S2	30,57 ^a ± 1,09
	S7	18,25 ^b ± 1,30
Diesel oil + Tween 80	S2	30,81 ^a ± 0,63
	S7	18,32 ^b ± 0,38
Diesel oil + SDS	S2	30,25 ^a ± 0,53
	S7	18,14 ^b ± 0,30
SAE 40 used oil	S2	15,46 ^{bc} ± 1,24
	S7	13,73 ^c ± 1,51
SAE 40 used oil + Tween 80	S2	18,15 ^a ± 0,46
	S7	16,76 ^{ab} ± 0,55
SAE 40 used oil + SDS	S2	16,86 ^{ab} ± 0,69
	S7	13,81 ^c ± 0,21
SAE 50 used oil	S2	16,88 ^b ± 0,85
	S7	13,41 ^c ± 1,90
SAE 50 used oil + Tween 80	S2	18,83 ^a ± 0,32
	S7	16,01 ^b ± 0,67
SAE 50 used oil + SDS	S2	16,99 ^b ± 0,18
	S7	13,63 ^c ± 0,32

Table 1: Biodegradation of hydrocarbons supplemented or not with surfactants

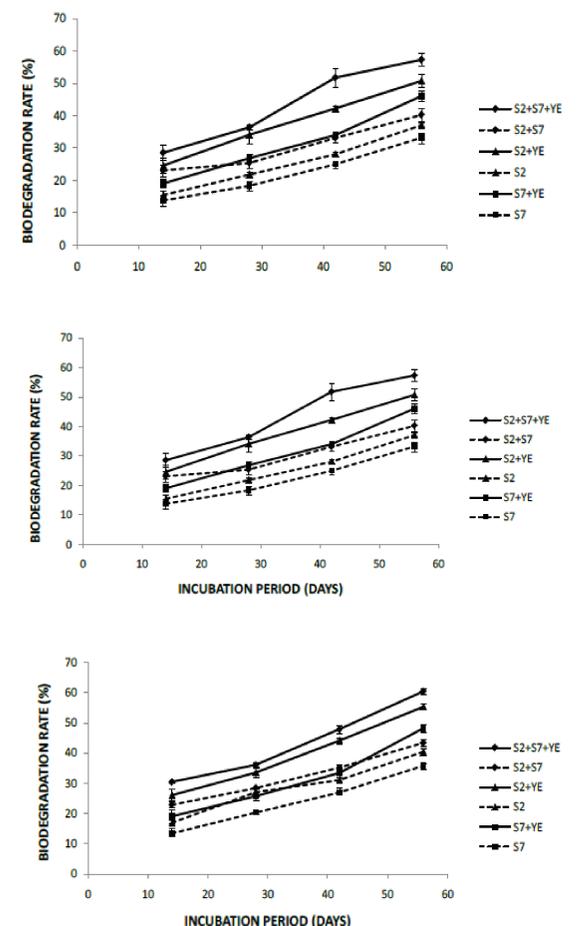


Figure 2: Biodegradation of hydrocarbons (supplemented or not with yeast extract) with regards to incubation period. YE: Yeast Extract.

Effect of incubation period on diesel oil, SEA 40 and SAE 50 used oils biodegradation Case of diesel Oil

After 14, 28, 42 and 56 days incubation periods in diesel oil, SAE 40 and SAE 50 supplemented or not with yeast extract, the biodegradation rate obtained are presented in figures 2 (a, b and c).

CONCLUSION

This study shows that S2 and S7 strains and their association are able to degrade SAE 40/50 used oils and diesel oil after a 14 day incubation period, and more efficiently for an extended incubation period.

Therefore, nutrient factors (yeast extract and peptone) and surfactant (tween 80) can be utilized effectively to reclaim water contaminated with diesel and used oils.

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