

## Biodegradation of 2,4 DCP herbicide by *Streptomyces collinus* isolated from from wastewater treatment plant in eastern Algeria

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### Introduction

2-4 Dichlorophenol (2-4 DCP) is a chlorophenic compound widely used to produce herbicides, antiseptics and wood preservatives. This product is carcinogenic and considered a typical wastewater ubiquitous. The physico-chemical removal routes of 2-4 DCP from wastewater are however limited, due to their cost as well as their toxic impact on the environment. Biological removal techniques using degrading bacteria are more reliable and advantageous.

Actinobacteria are known for their great enzymatic and metabolic biodiversity, *Streptomyces* are the major representatives of actinomycetes. They are widespread in nature. These bacteria play a very important role in the biodegradation of the most diversified compounds. Studies on the isolation of *Streptomyces* from wastewater treatment plants (WWTPs) are very rare and limited to only a few genera among the actinomycetes such as *Nocardia* and *Rhodococcus*.

# Aims of the study

- ✓ Evaluate the functionality of the Ibn Ziad wastewater treatment plant in Constantine.
- ✓ Isolated and selected *Streptomyces* capable of degrading 2-4DCP.

## Material and methods

- 1. Samples collected:** Raw wastewater (RW), activated sludge (AS), purified wastewater (PW) at Ibn Ziad WWTP.
- 2. Physico-chemical analysis:** pH, Temperature, Conductivity, Salinity, Suspended Matters (MES), Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD5).
- 3. Isolation of *Streptomyces* strains:**

Isolation media: AF, Czapeck dox modified, ISP4, Olson

Incubation at 30°C for 21 days

*Streptomyces* strains are identified by their macroscopic and microscopic appearance

- 4. Preliminary selection of 2-4DCP tolerant *Streptomyces*:**

25 isolates of *Streptomyces*

Agar minimum medium (MM) + 50mg/L of 2-4DCP

30°C-21 days

18 strains were able to grow, four of which showed good growth.

- 5. Secondary selection of *Streptomyces* in liquid medium:**

30°C- 30 days- 130rpm

The four *Streptomyces* strains

250ml bottle containing 75ml of MM+ 50mg/L of 2-4DCP

Degradation kinetics by HPLC

Growth kinetics by spectrophotometer

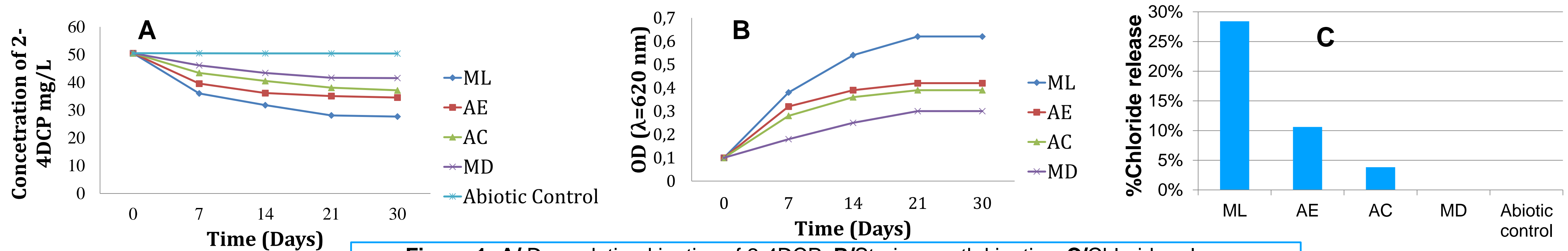
Chloride release by colorimetry

- 6. Identification of the performing isolate:** Morphological, biochemical, physiological and molecular characterization.

# Results

**Table 1:** Physico-chemical characterization

parameter	pH	T (°C)	Conductivity (µs/cm)	Salinity (%)	MES (mg/L)	COD (mg/L)	BOD5 (mg/L)
<b>RW</b>	7,95	22	17711,66	0,83	281,66	712,33	353,33
<b>AS</b>	9,9	21,1	1433,33	0,8	17,5	580	42,66
<b>PW</b>	7,88	21,96	1590	0,6	74	42,66	75



## Conclusion

- According to the results of the physico-chemical characteristics of the water sampled at the inlet and outlet of the plant, the biological treatment by activated sludge used in this WWTP is effective and allows the elimination of certain organic pollutants.
- Several strains of *Streptomyces* were isolated from the activated sludge of the Ibn Ziad WWTP. The isolate named ML shows a high ability to biodegrade 2-4 DCP. The degradation of the substrate is obtained after 30 days of incubation with a rate of 45%. The identification of its 16S DNAr gene confirms its affiliation to the genus *Streptomyces* with a homology of 99% with *Streptomyces collinus*. Works on the use of *Streptomyces* in the biodegradation of 2-4 DCP are rare if not non-existent. This result is important and shows the involvement of *Streptomyces* in the biodegradation of this pollutant. This strain can be used in the different biological processes aiming at depolluting the aquatic environment of this type of chlorophenic compound. In order to improve the degradation potential of this strain, further studies on the optimization of degradation are necessary.