

# Improving the bio-reclamation efficiency of petrol-derived wastes with *Trichocladium Canadense*

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## INTRODUCTION

It is known that petroleum and its derivatives causes significant pollution in the environment as a result of accidents during the production, transportation and utilization processes. The low boiling compounds and aromatics present in the structure of the petroleum (including PAH and MAH) have toxic and even some carcinogenic effects on living organisms (Aydın et al., 2016). These wastes are not easily biodegradable due to the complex structure and accumulate in the soil which affect the soil structure and reduce the water retention therefore reducing its fertility (Mohan et al., 2011). Although the physical and chemical removal methods are applied to petroleum derived wastes seem to be effective, they cause secondary environmental pollution. Biological approach can be more environmental friendly and sustainable option to manage these wastes (Kolukırık et al., 2011). Consequently, the use of microorganisms capable of degrading toxic compounds known as bioremediation has become an attractive technology. Fungus species, producing ligninolytic enzymes reveal high efficiency especially in the degradation of low molecular weight PAHs (compounds with 2-3 ring structures). Some species such as *Trichocladium canadense* are effective on degradation of high molecular weight PAHs (compounds with 4-7 ring structures) (Silva et al., 2009; Aydın et al., 2016).

The aim of this study is to specify the biodegradation yield of petroleum-derived wastes with the help of *Trichocladium canadense*, a unique fungus species, and to determine the bioenergy production to be obtained from such wastes.

## MATERIAL AND METHODS

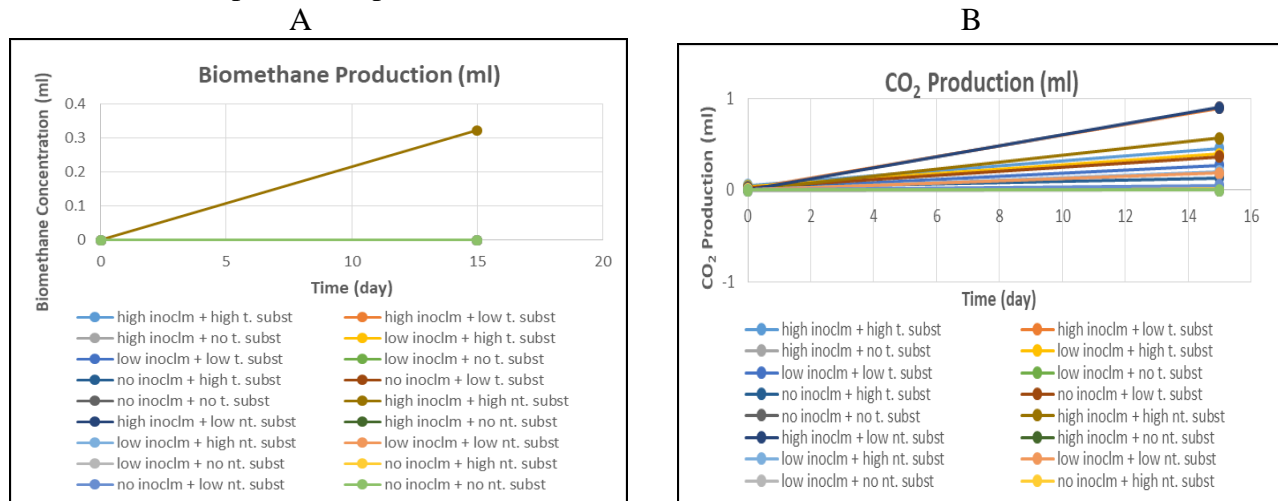
Soil which contaminated with petroleum waste sampling from Adana, Turkey was used as substrate and *Trichocladium canadense* (ATCC®201360TM) which incubated for 4 weeks at 25 ° C in Potato Dextrose Agar (PDA) medium with antibiotic (penicillin, ampicillin and kanamycin) was used as inoculum. Microcosm tests are performed with 3 different substrate concentrations (no substrate, 2.5 g and 5 g substrate), 3 different amount of *Trichocladium canadense* (no inoculum, 4 cm<sup>2</sup> and 8 cm<sup>2</sup> inoculum from agar plate), treated and nontreated substrate, aerobic and anaerobic digestion with total 36 different conditions. Each condition replicated 3 times (Silva et al., 2009)

Methane and CO<sub>2</sub> production is monitored by biweekly GC. Samples are taken once a month for microbial analysis and enzyme activity determination. NGS and TPH analysis will be done at the end of 24 weeks incubation (Ince et al., 2018; Çalışıyor, 2018). In order to increase bioefficiency prior to bioaugmentation, persulfate oxidation, which is a chemical pretreatment method, was found to be effective in the decomposition of C<sub>10</sub> - C<sub>40</sub> hydrocarbons. The minimum value was determined so that the persulfate chemical to be used as the oxidant does not leave toxic effects on the microorganisms already present. 0.4 g/g sodium persulfate (Na<sub>2</sub>S<sub>2</sub>O<sub>8</sub>) was used as oxidizer, 0.5

M of iron (II) sulfate (FeSO<sub>4</sub>) and citric acid was used as activator and filled with distilled water till 150 ml. (Wu et al., 2016)

## RESULTS

The results of the first 15 days of gas production were measured and shown below. The CO<sub>2</sub> production observed at maximum at high inoculum-low nontreated substrate microcosm (5 g substrate–4 cm<sup>2</sup> inoculum). As it seems below, biomethane production started and maximum at high inoculum-high nontreated substrate (5 g substrate – 8 cm<sup>2</sup> inoculum) and others not started yet. This work is still an ongoing project and data is still being collected. Once all analyzes have been completed, a microbial recipe for clearing soil contaminated with petroleum-based wastes is forecast and is expected to open the door to new research on contaminated soil and water.



**Figure A)** Methane production under anaerobic condition

**B)** CO<sub>2</sub> production under anaerobic condition

## ACKNOWLEDGEMENT

This study is supported by the Scientific and Technological Research Council of Turkey (TÜBİTAK, Project No: 115Y375).

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