MICROBIAL CO_2 OUTPUT FROM A FIRE FOAM AND GASOLINE CO-CONTAMINATION SCENARIO

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From oilrigs to the transportation and distribution of petrochemicals, there is always a risk of accidents that may result in fires. To extinguish such fires, aqueous film forming foams (AFFF) are often used, since fluorinated compounds contribute to the fire extinguishing capability. In emergencies, tons of AFFF are released into the environment and therefore can affect the environment in the long term even after the fire is out. The fluorine-carbon bonds are highly resistant to degradation and therefore have long environmental persistence. In this study we determined the biodegradation potential of a microbiota for mixtures of AFFF in gasoline. Studies have been conducted with respirometric techniques to study the biodegradability of AFFF in co-contamination scenarios. Through this methodology we determined CO_2 concentrations in the micro-atmosphere created inside the respirometer, as indirect evidence of biodegradation. Bioassays were developed on respirometric 250 ml flasks containing 0.5 ml of gasoline and 100 ml of AFFF in a 50 g of soil matrix corresponding to actual data of environmental contamination within the measurement window allowed by the technique, (100 to 1,500 µmol of CO_2). The petroleum hydrocarbons influenced the metabolism of the microbial communities during the application of fire foams. The average production reached 147.47 ± 3.1 µmol of CO_2/week in vials containing only AFFF and 326.91 ± 15.3 µmol of CO_2/week in vials containing AFFF and gasoline. The positive effect on CO_2 production in co-contamination (5930.61 ol) was greater than the accumulated values of the individual essays containing gasoline or AFFF (3059.71 and 2354.54 µmol, respectively). The addition of AFFF caused an overall greater efficiency degradation, especially at the beginning of treatment, promoting a higher average CO_2 output. This may be related to the surfactant effect of the AFFF solution in hydrophobic gasoline molecules. Contamination by AFFF may take more metabolic steps during hydrocarbon biodegradation process due to the emulsifying capacity, reaching 28.63% gains in the release of CO_2. These molecules increase the bioavailability of hydrocarbons and therefore favor biodegradation.

Palavras-chaves: AFFF, surfactant, respirometry

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