EFFECT OF BIODIESEL ON THE INTERACTION OF MICROORGANISMS WITH POLYETHYLENE

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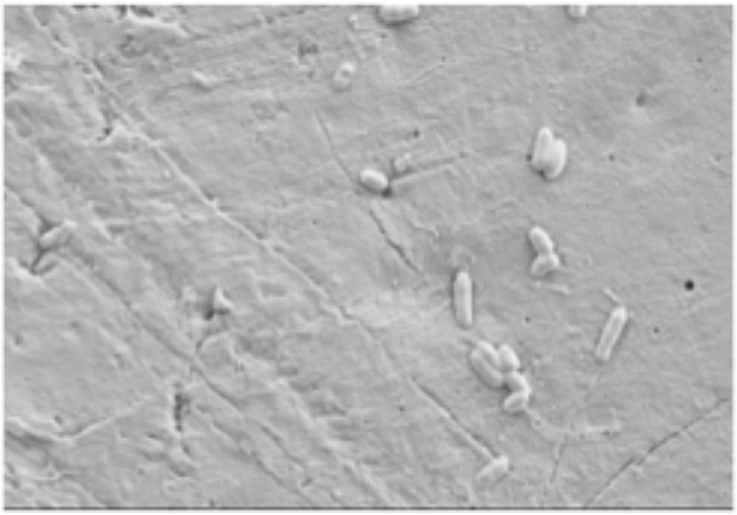
Biodiesel has been gaining an important place in the fuels market as a replacement for regular diesel. Concerns regarding both the sustainability and stability of the supply chain of regular diesel have led to a growing biodiesel industry. In Canada, by law, all diesel fuel must contain a mixture of 2% biodiesel. The addition of a new compound to diesel can have an impact on the corrosive properties of the fuel; this is a potential danger for the contacting infrastructure. An important fraction of the infrastructure (mainly storage tanks) is made of polyethylene, a polymer thought to be chemically and biologically neutral. Currently, there is a lack of studies that explore the possible effects of biodiesel compatibility with polyethylene.

The effects of biodiesel addition on polyethylene can be explained by two different mechanisms, on the one hand there is a possible chemical interaction and on the other, it is possible that biodiesel favors the development of microorganisms capable of metabolize the polymer. The scope of this work is to explore the second hypothesis. This hypothesis is supported by previous studies that have found microorganisms able to degrade polyethylene.

It is known that diesel and biodiesel storage tanks usually have a water layer produced by condensation of environmental moisture; this water layer constitutes a perfect place for the development of microorganisms that can use the fuel as carbon source. Given that the chemical nature of biodiesel is different from the chemical nature of regular diesel, it is reasonable to think that addition of biodiesel can lead to changes in the microbial population present within a fuel tank.

These changes in the microbial composition may or may not have an effect on the way the microorganisms interact with the surface of containers. However, it must be highlighted that there is important evidence showing how environmental conditions can affect the ability of microorganisms to interact with surfaces. Microbial interactions with materials are usually mediated by biofilm formation, a kind of structure that is formed on the surface that binds them irreversible to the surface. The organisms use the material as a support as well as a source of nutrients to maintain their metabolisms. Bio-corrosion processes are therefore usually very dependent by whether biofilm formation occurs on the surface of a material. To study the interaction of microbial communities with polymers there are different methodologies. Some important ones are the biofilm growth quantification and the imaging through SEM.

1. O. Gilan, Y. Hadar, A. Sivan, "Colonization, biofilm formation and biodegradation of polyethylene by a strain of Rhodococcus ruber", Applied Microbiology Biotechnology 65, 1(2004):p.97-104.
2. T. Muthukumar, A. Aravinthan, K. Lakshmi, R. Venkatesan, L. Vedaprakash, M. Doble, "Fouling and stability of polymers and composites in marine environment" International Biodeterioration and Biodegradation 65, 2(2011):p.276-284.



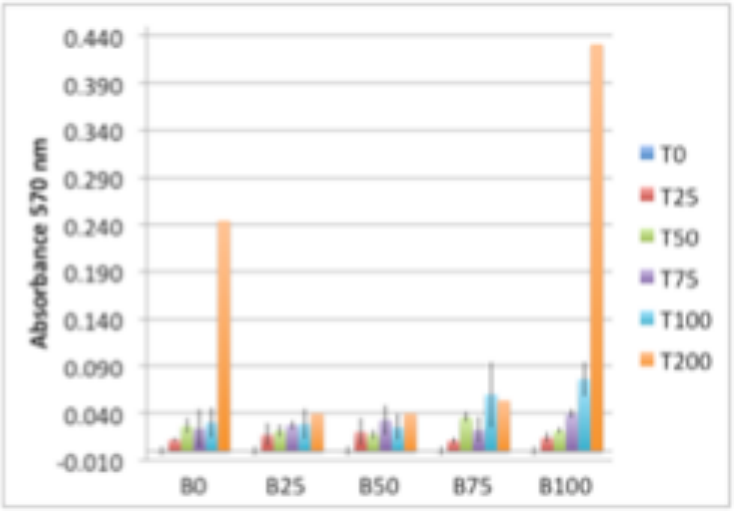


Figure. In the left it is shown a group of microorganisms attached to a surface of polyethylene in the right a growth curve for biofilm in polyethylene in media containing biodiesel in concentrations from 0 to 100%.

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