

ID27- LOW COST OPTIC SENSOR FOR HYDROCARBON DETECTION IN OPEN OCEANS

Lorena Parra¹³⁷, Sandra Sendra¹³⁸, Jaime Lloret¹³⁵, Jonatan Mendoza¹³⁶

Abstract— Hydrocarbons are one of the most important toxics in the oceans. Their presence may cause the death of organisms. They even can affect to the human beings, when they consume products that have been in contact with the hydrocarbons. After a hydrocarbon spillage, the fishing activity, the tourism, the safety and the wildlife are endangered. The fast detection is very important in order to start as soon as possible the cleaning tasks. It can be done using sensor networks. The first step in order to create a water quality monitoring system is to obtain a good hydrocarbon sensor. The sensor must be robust and cheap. There is no needed of high accuracy, the objective is just to detect the presence of the hydrocarbon in the water surface. In this paper, we present a low cost optic sensor capable of distinguishing the presence or absence of hydrocarbon in the water surface. The sensor is formed by light-emitting diode (LED) as a light source and photoreceptor as a receiver. In order to create the sensor, several tests have been done using different light sources. The light sources have different wavelength (violet, blue, green, orange, red and white). In order to test our samples, six samples are prepared. The samples are made of sea water and fuel (as they are one of the typical hydrocarbons). After the first tests, the best wavelength is selected and it is studied in detail. The lights selected were violet, orange and white. After the detailed tests, the light source that offers best results was the white light.

Keywords-hydrocarbon pollution; optic sensor; photodiode; hydrocarbon detection; LED light

MOTIVATION

One of the causes of hydrocarbon pollution in oceans are the ship accidents. They generally become an international affair. Hydrocarbon pollution affects several organisms from terrestrial to marine ones. The plants and animals, even the human society are affected. According to [1] between 2002 and 2006 there were up to 7500 spills in US waters. The number of spills caused by vessels has been reduced in the last decades; nevertheless the number of spills related to pipelines has quadrupled from 1990 to 2010 [2]. One of the worst problems to remove the hydrocarbon spillages is that hydrocarbons tend to disperse and mix with the water. This dispersion complicates the possibility of removing the pollution. While some pollutants affect only one specific animal the hydrocarbon effects can be seen in all the species of the polluted area [3]:

Hydrocarbon creates an impermeable layer over the water that avoids the gas exchange between water and atmosphere.

Oil layers reduce the incident light, affecting the photosynthetic capacity of the phytoplankton

Birds have several problems such as intestinal problems and skin irritation, among others.

Fishes death by asphyxia because of their skin and gills are covered by the hydrocarbon.

Marine mammals are covered by hydrocarbon which causes the loss of their floating capacity.

RESULTS

In order to create a low cost hydrocarbon sensor, we tested six different light sources. We changed the light wavelength to violet, blue, green, orange, red and white. Different samples are used to perform the tests. The experimental assembly and the location of the photoreceptor can be seen in Figure 1. The samples are made of sea water and fuel (unleaded gasoline of 95 octane) at different concentrations from 0% to 33%. The results of the first tests with all used lights are shown in Figure 2. Three light sources are selected to make deeper analysis: violet, orange and white. The best results have been obtained with the white light. The cost of the sensor is around 3€.

(right) **Figure 2. Output voltage registered at the photoreceptor output using different light colors.**

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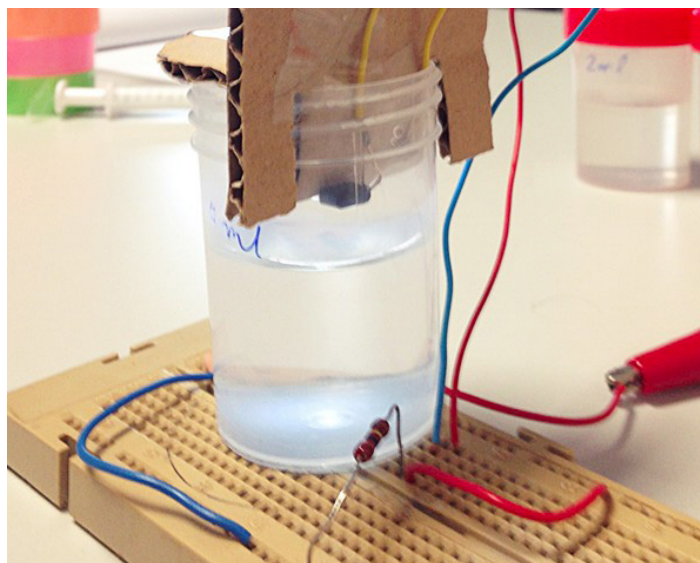


Figure 1. Set up of the experiments to select the best light source.

