Degradation of formaldehyde in water by CWO

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1. Introduction – Most of the wastewater generated by the chemical industry and the transformation are discharged with the presence of organic pollutants, in many cases they contain refractory organic compounds such as formaldehyde in a very low concentration for their recovery to be profitable, but it is high enough to be a source of significant contamination [1]. In order to solve this problem it is necessary to develop new technologies that give an effective treatment to this type of contaminated effluents and contribute in reducing the environmental impact to the bodies of water that causes a loss of biodiversity and retards a sustainable development [2].

2. Experimental - The degradation of formaldehyde in water was studied by means of the catalytic wet oxidation reaction in a batch reactor with Parr brand agitation varying operating variables: temperature, 25 and 60 °C and pressure of 1 and 2 atmospheres, the catalyst mass in all the runs were 1 gram of catalyst per liter of solution, the initial concentration of the solution was 100 ppm of formaldehyde, in all cases the total reaction time was 4 hours and samples were taken every 30 minutes to measure the pH and formaldehyde concentration by chromatographic analysis. Ce-Cu-Cu mixed oxide catalysts supported on alumina were used by the incipient wet impregnation method, the catalysts were characterized using the techniques of: X-ray diffraction (XRD), scanning electron microscopy (SEM / EDS), reduction at programmed temperature (TPR) and infrared spectroscopy (FTIR) of fresh catalysts and using in the reaction.

3. Resultados and Discusión - The results obtained by XRD of the mixed oxides, present the characteristic peaks of the cerianite in the planes (111), (200), (220), (311), (222) and (400). A greater intensity was observed in the peaks characteristic of cerianite compared to those of copper, or those of cobalt because the cerium precursor solution was prepared with higher concentration. The programmed temperature reduction analysis showed three hydrogen consumption peaks, the first with a maximum at 170 °C, the second at 190 °C and the third at 223 °C, suggesting that there is a strong interaction between the three metal oxides. The SEM / EDS analysis shows the typical morphology of the support in its alpha phase with a uniform coating of incorporated particles, referring to the metals of Ce, Co, Cu with a higher weight percentage of Ce. The highest percentage of conversion obtained was in the catalytic reaction at the temperature of 60 °C and pressure of 2 atm. The FTIR analyzes made to the catalysts after reaction showed adsorbed secondary products, by gas chromatography the presence of any secondary product in solution has not been detected.

4. Conclusions - The results of catalytic activity have shown that it is possible to eliminate formaldehyde through advanced oxidation processes such as CWO. The effect of pressure and temperature are very marked since the highest percentage of elimination of the contaminant was obtained at the temperature of 60 °C and at the pressure of two atmospheres of the oxidizing agent.

5. References