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High Entropy oxides as catalysts in advanced oxidation processes for wastewater treatment

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High-entropy oxides (HEOs) are a group of relatively new oxide materials having at least five cations, and consequently a high degree of structural disorder. These five different metal oxide components are simultaneously contained in a single-phase crystal system, whereby the metal ions can have completely different ionic radii, which leads to a so-called structural lattice distortion effect. The distorted lattice (or strain in the crystal structure) is the obstacle to dislocation movement, which increases the strength and reduces the ductility of the finished material. HEO materials are also attributed to the so-called cocktail effect, where the different elements act synergistically and therefore also exhibit excellent catalytic properties. They have a great potential for application in various fields, including catalysis, electrochemical energy transformation and the environment. Various catalysts for catalytic ozonation, including homogeneous and heterogeneous catalysts, such as metal ions, metal oxides, and carbon-based materials are recently being investigated in terms of advanced oxidation processes. Two new innovative approaches for HEO synthesis were presented: combustion synthesis and solvent deficient method. The composition and morphology of resulting HEO products were analyzed using XRD powder diffraction method and FE-SEM equipped with EDS detector. The aim of our study was to synthesize rock-salt HEO ($Mg_{0.2}Co_{0.2}Ni_{0.2}Cu_{0.2}Zn_{0.2}$)O and test its efficiency as catalyst in advanced oxidation processes based on Fenton reaction and ozonation. Batch experiments were conducted in laboratory scale and treatment efficiency of methylene blue as a model compound was studied using absorbance measurements. Toxicity of the leachates of HEO was also determined using *Lemna minor* to assess its impact to aquatic environment. It was confirmed, that investigated HEO could be used as a catalyst in oxidative treatment of micropollutants but its efficiency is strongly dependent upon reaction conditions.