ALKALINE EARTH METAL STANNATE PEROVSKITES AS EFFECTIVE ADSORBENTS OF ORGANIC DYE POLLUTANT CONGO RED

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Congo Red (CR) is an organic colourant which is broadly used in chemical, textile, paper, cosmetic, and pharmaceutical industries [1]. Extensive application of the azo-dyes in different industrial sectors also produces a large amount of heavily polluted wastewater that endangers the aquatic ecosystem [2]. The azo-dyes show superior stability to light, heat and aggressive chemicals due to their structural characteristics, which also makes them hardly degradable by traditional approaches. Moreover, the biodegradation of the azo-dyes typically leads to the formation of mutagenic aromatic amines [2]. Therefore, development of alternative methods for discolouration of the wastewaters in commercial-scale applications is a topic of great scientific interest.

Removal of the azo-dye by physical or chemical adsorption is a low-cost method being used on a commercial scale in different industrial. Its advantages in comparison with other physic-chemical methods include low operating costs, high absorption capacity, possibility of treatment of highly polluted effluents, quick removal rate of the pollutant, and in some cases even possibility of regeneration of the adsorbed dye and re-usability of the adsorbents [1,2]. Oxide perovskites are one of the least studied adsorbents of organic pollutants, but are considered to be highly perspective for this application [3].

The formation of pure phase perovskites of Ca and Sr stannates was achieved by thermal decomposition of double hydroxides ($ASn(OH)_6$, A = Ca, Sr) obtained by co-precipitation under varying conditions. It is shown that the nature of the initial reagents and their concentration, the presence of additives (PEG and triethanolamine), the initial pH and the aging time did not influence the properties of $ASnO_3$. However, the processing temperature and the sequence of the mixing of the ingredients influenced the surface area and porosity of the product. Moreover, the trend in the change of the surface area and porosity of $ASnO_3$ was different for Ca and Sr, which agrees with the different thermal behaviour of $ASn(OH)_6$.

All studied samples showed high adsorption capacity toward CR (studied at C_0 = 10, 50 and 100 mg L^{-1}). The removal efficiency of CR varied between 3 and 90% (24 h contact period, initial pH 7). In comparison to the previously reported results, adsorption capacity of the studied samples is much higher (48 mg g^{-1} vs 24-36 mg g^{-1}) at the similar conditions. The highest adsorption capacity showed $CaSnO_3$, which calcination at higher temperature had a positive impact on adsorption. For $SrSnO_3$, an increase in the calcination temperature had an opposite effect, which agrees with the trend of surface area change. The study shows great potential of $ASnO_3$ perovskites as adsorbents for wastewater treatment on large scale applications.

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