# SIIC052

# REVIEW ON THE PHYSICOCHEMICAL PROPERTIES OF PEROVSKITE AS CATALYSTS FOR WATER AND WASTEWATER TREATMENT

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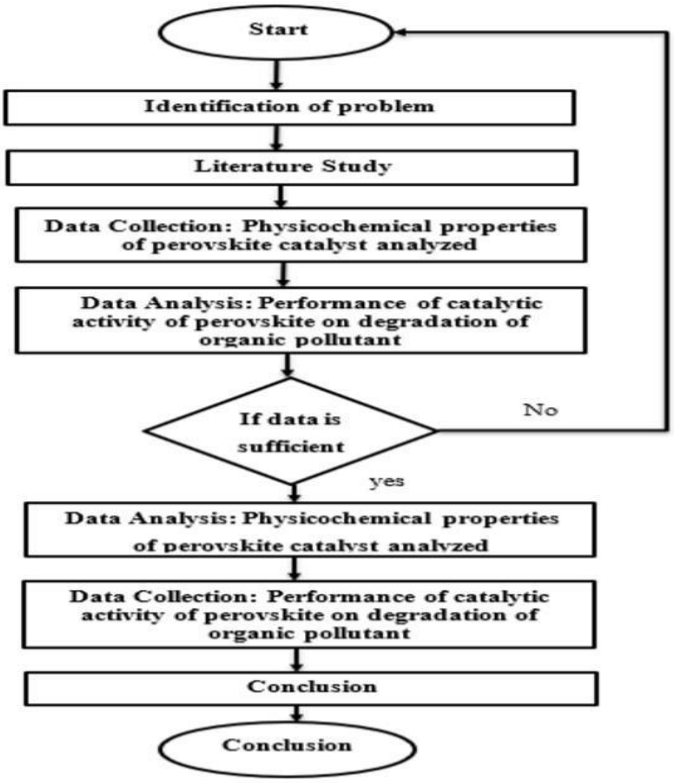
***Abstract:***
The main objective of this study is to review the physico-chemical investigations of perovskite catalyst on water and wastewater treatment. Advanced Oxidation Process (AOP) method treat the organic contamination effluent from industry that uses organic components or elements by generated highly oxidizing hydroxyl radicals (HO.). The general formula of perovskite catalyst is ABO3 where A-site is a type of rare earth metal while B-site is a transition metal which known to be heterogeneous catalyst that help to degrade the organic effluent under dark ambient conditions. This comparative study compares the performance of catalytic activity of perovskite catalyst based on its physicochemical properties. The scope of work on overall paper determine the percentage of degradation of organic pollutants which correlated to the perovskite's physicochemical properties. The research methodology used the data collection and analyzed them in the previous study to fulfill the research on the study by putting together all notable related journals, past studies and research works done. Therefore, the study of perovskite catalyst is analyzed by using scanning electron microscopy (SEM), Transmission Electron Micrographs (TEM), X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), thermogravimetric analysis (TGA) and Texture profile analysis (TPA). As a result, perovskite catalyst is very effective in degrading methyl orange under dark ambient condition from low 10 ppm to high 100 ppm concentrations between 20-90 minutes, thus generating electrons which reacted with dissolved O2 in the solutions to yield reactive species such as HO• for further degradation and mineralization. The perovskite catalyst have an active surface of catalyst that can help fasten the degradation of organic in wastewater by adsorption of organic onto the active surface of perovskite catalyst. Therefore, it is considered stable under the oxidative conditions and their thermal stability was better for the possible used on organic wastewater treatment.

***Keywords*:**
Perovskite catalyst;Catalyst characterization;Advanced Oxidation Process;Heterogeneous catalyst;Wastewater treatment

## *Objectives:*

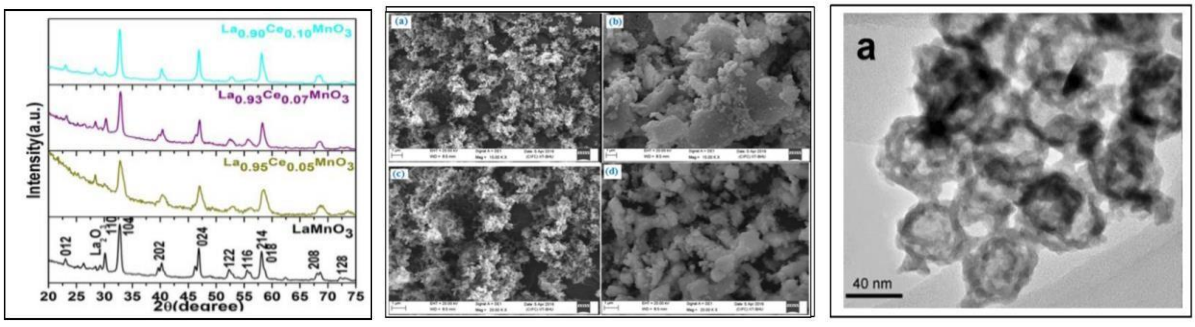
- To review the physicochemical properties of the perovskite catalyst.
- To compare the performance of catalytic activity of perovskite catalyst based on its physicochemical properties.

## *Methodology:*

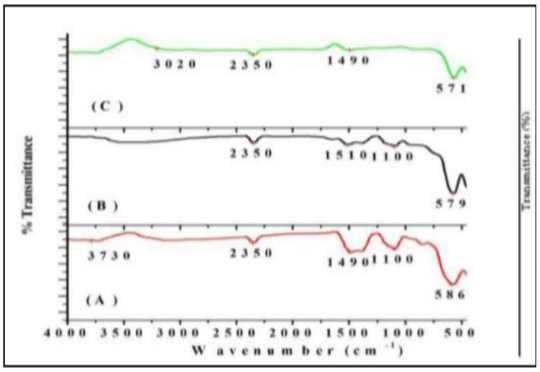



## *Results:*

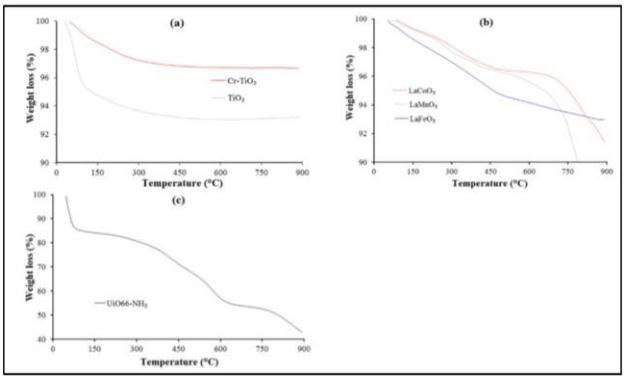
**XRD-LaMnO3, La0.95Ce0.05MnO3 La0.93Ce0.07MnO3 and La0.90Ce0.10MnO3 , SEM micrographs La0.65Ag0.35MnO3 catalyst AND TEM image of hollow LaCoO3 spheres**



**FTIR spectra of (a) LaCoO3, (b) LaFeO3, (c) LaNiO3**




**Thermogravimetric analysis (TGA) of photocatalysts: (a)TiO2-*based catalysts (b) LaBO3 perovskites and (c) UiO66-NH2***




## *Conclusion:*

As a conclusion, the comparative study on the topic is relevant and reliable based on the results and discussion obtained. The physicochemical properties of perovskite catalyst were analyzed by using different characterization techniques such as SEM, TEM, FTIR, XRD, TGA and TPR. The perovskite type catalyst such as $LaMnO_3$, $LaCoO_3$, $LaFeO_3$, BaSrCo, $LaAlO_3$ and $SrCeO_3$ were discussed on its characteristics of perovskite. These perovskite type catalysts mainly follow and obeys the perovskite rules which is $ABO_3$ perovskite type catalyst. All the A-site were the rare earth metal (A= La, Ba, Sr), while the Bsite doping is a transition metal (B= Mn, Co, Fe, Al) and allowing other variety of metal ions in both A and B site positions. The rare-earth manganates have a high potential for applications based on their physico-chemical properties Besides, the perovskite type catalyst process is under the AOPs condition which act as the heterogeneous catalyst for degradation of water and wastewater (organic) effluent. The XRD pattern on perovskite catalyst of $LaMnO_3$ and $LaAlO_3$ contains high crystalline with low surface area with changing of B-site doping from Mn to Al element. Next, the SEM shows results on topography and morphology of the perovskite type catalyst which shows the lumped type images at $LaCuO_3$ and $LaNiO_3$ perovskite catalyst. By this technique, it can be concluded that these perovskite catalysts are able to give the best results with 80% degradation in 10 minutes and 95% in 60 minutes degradation. Thus, it is considered stable under the oxidative conditions and their thermal stability was good enough for the possible used on organic wastewater treatment and exhibits largely open porous structure which the black spots images shows the pores in $LaMnO_3$ perovskite. The review study has shown that lithium, magnesium, and calcium are the most feasible for industrial oxidation processes. This conclusion is in good agreement with contemporary practice of perovskite type catalyst and related compounds usage in treatment of water and organic wastewater treatment. Somehow, the percentage of degradation of organic pollutants which correlated to the perovskite's physicochemical properties concluded that more than 50% degradation can be reached, and that this perovskite catalyst is a suitable method on the treatment.