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Novel biohybrids of layered double hydroxide and lactate dehydrogenase enzyme: Synthesis, characterization and catalytic activity studies

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The present work introduces new biohybrid materials involving layered double hydroxides (LDH) and biomolecule such as enzyme to produce bioinorganic system. Lactate dehydrogenase (Lac Deh) has been chosen as a model enzyme, being immobilized onto MgAl and ZnAl LDH materials via direct ion-exchange (adsorption) and co-precipitation methods. The immobilization efficiency was largely dependent upon the immobilization methods. A comparative study shows that the co-precipitation method favors the immobilization of great and tunable amount of enzyme. The structural behavior, chemical bonding composition and morphology of the resulting biohybrids were determined by X-ray diffraction (XRD) study, Fourier transform infrared (FTIR) spectroscopy and transmission electron microscopy (TEM), respectively. The free and immobilized enzyme activity and kinetic parameters were also reported using UV-Visible spectroscopy. However, the modified LDH materials showed a decrease in crystallinity as compared to the unmodified LDH. The change in activity of the immobilized lactate dehydrogenase was considered to be due, to the reduced accessibility of substrate molecules to the active sites of the enzyme and the partial conformational change of the Lac Deh molecules as a result of the immobilization way. Finally, it was proven that there is a correlation between structure/microstructure and enzyme activity dependent on the immobilization process.

Keywords: Bioinorganic system, Layered Double Hydroxide (LDH), Lactate Dehydrogenase (Lac Deh), Enzyme immobilization, Catalytic activity.

Biography:

Mohamed Amine Djebbi is currently a third year PhD student working under the supervision of Doctor-engineer Philippe Namour at the University of Claude Bernard Lyon 1 Institute of Analytical Science. Prior to beginning the PhD program, Mohamed received his master degree from the University of Carthage Faculty of Science of Bizerte in 2013. He currently working on the thesis entitled “Hybrid and Biohybrid Layered Double Hydroxide: Electrochemical Applications”. His research is focused particularly on the use of hybrid and biohybrid LDH materials in biosensor and biofuel cell.