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# Adsorption of Benserazide by Aluminum Magnesium Layered Double Hydroxides: Hydrophobic Effect.

J.F.Naime Filho(1)*, M.O.Ribeiro(1), J.B.Valim(1)
(1)Departamento de Química. Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, Universidade de São Paulo, 14040-901, Brazil.
* jfnaime@yahoo.com.br

**Abstract** – Layered Double hydroxides (LDH) are materials that have been prepared and characterized due to their large range of applications. These materials have structures that are based on the stacking of bucite–like layers, positively charged due to the isomorphic substitution of cations in $M^{2+}$ by $M^{3+}$. To achieve the neutrality, these layers are intercalated with hydrated anions, resulting in the structure of layered double hydroxide. In this work, we propose the preparation and characterization of LDHs as support for adsorption of benserazide, one of the drugs that are often used in the formulation of Parkinson's disease medicines.

Layered double hydroxides (LDH), also known as hydrotalcite-like compounds, present positively charged layers, resulting from the isomorphous substitution of bivalent cations by trivalent ones this results in a positive charge, neutralized by hydrated anions stacked between the layers. In addition, magnesium aluminum LDHs are biocompatible. In recent years, in order to demonstrate the feasibility of LDH-based tunable drug delivery systems, a series of pharmaceutically active compounds, such as ibuprofen, diclofenac, gemfibrozil, naproxen, 2-propylpentanoic acid, 4-biphenylacetic acid, tolfenamic acid, indomethacin, and fenbufen, have been intercalated/adsorbed into LDHs.

Benserazide, 2-amino-3-hydroxy-*N*′-(2,3,4-trihydroxybenzyl)propanehydrazide, is one of the dopa-decarboxylase inhibitors most commonly employed in the treatment of Parkinson's disease, and it's also used in the treatment of RLS (Restless Legs Syndrome). The aim of this work was to study the adsorption of benserazide by magnesium aluminum layered double hydroxide in different conditions, in order to enhance the removed amount and apply this drug in pharmaceutical formulations [2].

The adsorption experiments were performed by monitoring the variation in the concentration of a benserazide solution in contact with: magnesium/aluminum-dodecylsulfate LDH (MgAlDS-LDH); and magnesium/aluminum-carbonate LDH ($MgAlCO_3$-LDH) and its calcined material (MgAl-Calc). The benserazide solutions, before and after the contact with the solids, were quantified UV-visible spectroscopy and the resulting solids were analyzed by Fourier Transform Infrared Spectroscopy (FTIR) and Powder X Ray Diffraction (PXRD).

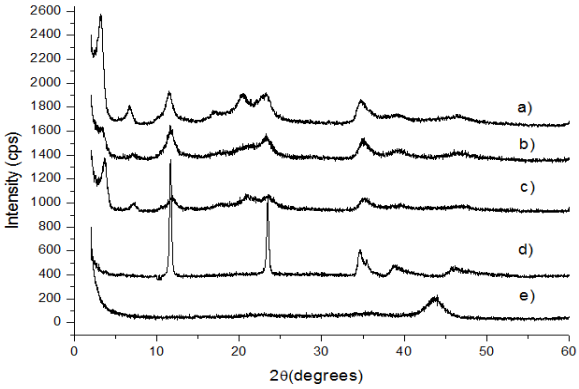


**Fig1:**PXRD in different conditions: **a)** MgAlDS-LDH pure; **b)** MgAlDS-LDH with benserazide; **c)**MgAlDS*-LDH with benserazide; **d)**$MgAlCO_3$-LDH with benserazide, and **e)** calcined-LDH with benserazide

**Table 1:** Amount of adsorbed Benserazide

| λ=270nm | |
|---|---|
| Adsorbent | [Benserazide](%)** |
| MgAlDS*-LDH | 43,3 |
| MgAlDS-LDH | 49,5 |
| $MgAlCO_3$-LDH | 10,3 |
| LDH-calcined | 18,8 |

*LDH-MgAlDS subjected to the indirect synthesis method for double-phase exchange[1] **Concentration of Benserazide in solution=97mg.dm$^{-}$

From the PXRD analysis we can see that there is no regeneration of the calcined material, and that there is not any anion exchange of carbonate or dodecylsulfate in the LDH, either as expected the adsorption on the calcined material was higher than that in the original $MgAlCO_3$-LDH, due to the increase in the surface area caused by calcination. The results show that the adsorption on MgALDS-LDH is much higher than that in the calcined material (about twice). When we used the double phase method [1] to remove the dodecylsulfate by forming a complex with the cetyl trimethylamonium anion , which is removed from aqueous solution to the chloroform phase, the amount of adsorbed benserazide was slightly lower than that in the aqueous suspension of MgALDS-LDH. So we conclude that hydrophobilization is responsible for enhancing the adsorption capacity by 100%.

**References:**

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[2] Deleu D., Northway M. G., Hanssens Y.*Clin Pharm.t*, **2002**, *41*, 261-309.