11th International Conference
on Advanced Materials

Rio de Janeiro Brazil
September 20 - 25

ICAM2009

A copper-isophatalate-bipyridine polymer: thermal analysis (TGA/DSC/MS) and studies about the capacity for incorporation of drugs

João H. P. Aduan* and Denise de Oliveira Silva

Instituto de Química, Universidade de São Paulo, São Paulo, Brazil; e-mail: jhaduan@usp.br.
* Corresponding author.

Abstract: Recently, hybrid systems based on the use of porous metal-organic frameworks (MOFs) as new controlled delivery systems have been proposed. In the present work we have prepared the reported polymer $[Cu(ip)(bipy)]_n \cdot 3nH_2O$ by hydrothermal method. Thermal studies have been extended to DSC/MS techniques and the capacity of the polymer for incorporation of drugs has been investigated. The model drug used is ibuprofen (Hibp) a non-steroidal anti-inflammatory drug used in large scale in all over the world.

Several polymeric and mixed systems have been proposed for controlled release of drugs. The majority of them are organic systems. The most known inorganics are ordered mesoporous silicas. However, the processes lead to a decrease of the drug storage capacity. Recently, hybrid systems based on the use of porous metal-organic frameworks (MOFs) as new controlled delivery systems have been proposed [1].

A copper coordination polymer of formula $[Cu(ip)(bipy)]_n \cdot 3n\ H_2O$, where ip is isophathalate and bipy is 4,4´- bipyridine, has been reported in the literature [2]. The structure is described as a bidimensional box-like containing $[Cu(ip)(bipy)]_n$ layers. TGA studies in N_2 atmosphere indicated only one step for weight loss at the range of 291-313^oC. No DSC/MS data have been reported.

In the present work we have prepared the polymer $[Cu(ip)(bipy)]_n \cdot 3nH_2O$ (Cuipbipy) by hydrothermal method as reported before [2] and it was characterized by elemental analysis and FTIR vibrational spectroscopy. Thermal studies have been extended to DSC/MS techniques and the capacity of the polymer for incorporation of drugs has been investigated. The model drug used was ibuprofen (Hibp) - a non-steroidal anti-inflammatory drug used in large scale in all over the world.

TGA curve in N_2 agrees with data described before [2]. The polymer undergoes thermal degradation in just one step with a sharp DTG peak at 299^oC. The event is endothermic as shown by DSC curve. The MS detection indicates that the main gases evolved in this process are: C_5H_5N, C_6H_6, CO_2 and NO_2. The calculated mass loss corresponds to a value that is close to that expected for a residue of copper oxide.

The polymer capacity for incorporation of Hibp has been investigated by isolating a solid from a mixture of Cuipbipy/drug/hexane. The X-rays diffraction powder (XRD) pattern of this material shows reflections in 2θ angles that are different from those observed for XRD patterns of Hibp and Cuipbipy indicating the formation of a new structure. TGA curve in N_2 shows degradation at the range of 150-350^oC with endothermic events. The main gases in these processes are the same as mentioned for Cuipbipy but they are evolved at slightly lower temperatures. Some other gases such as C_7H_8 and/or C_8H_{10} have also been detected. FTIR spectrum of the material indicates the presence of new bands at the region of 1700-1300 cm^{-1} in relation to the spectra of Hibp and Cuipbipy suggesting interaction of the drug with the copper-polymer.

Acknowledgments: FAPESP, CNPq.

References

[1] P.Horcajada, C. Serre, G. Maurin, N. A. Ramsahye, F. Balas, M. Valler-Regí, M. Sebban, F. Taulelle and G. Férey J. Am. Chem. Soc. 130 (2008) 6774-6780.
[2] Y. Wen, J. Cheng, Y. Feng, J. Zhang, Z. Li, Y. Yao, Inorg. Chim. Acta 358 (2005) 3347-3354.