PHYSICAL PROPERTIES OF Fe SPECIES IN SOME MEDICINES

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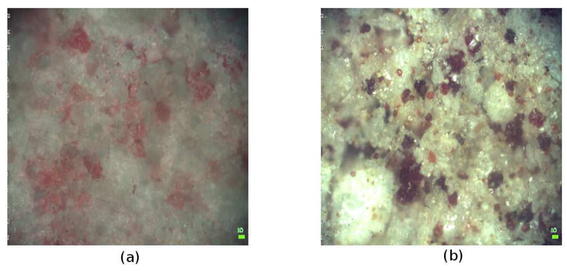
1. Motivation

^{57}Fe-Mössbauer spectrometry has long been used to identify the type of Fe-bearing phases, to detect the presence of any Fe-containing contaminant and to estimate its proportion, Fe coordination polyhedron, oxidation and spin states of each Fe species [1-3]. To the best of our knowledge, there is no report in the literature on the low temperature Mössbauer spectra of ferrous containing medicines. In this work, we have investigated six commercially available iron-bearing medicines by means of Mössbauer spectrometry performed at 300 K and 77 K. The physical origins of the two quadrupolar doublets in the 77 K spectra were interpreted in a similar way for the medicines based on ferrous sulfates and ferrous fumarates. It was assumed as due to the presence of several hydrated ferrous compounds.

2. Experimental Methods

Six different commercially available medicines were investigated in the present study: ferrous sulfates (Ferro-F-800®, Laproff®, IRON®), and ferrous fumarates (Mitrum vit™, Prenavit® and IOFI®).
These powdered materials to be delivered as dosage form, are subjected to a mixing process process with excipients to be distributed as pills. Prenavit® sample is wet.
The physical aspect of ferrous sulfate and ferrous fumarate with the excipients, can be first characterized by optical micrographs of Figure 1.



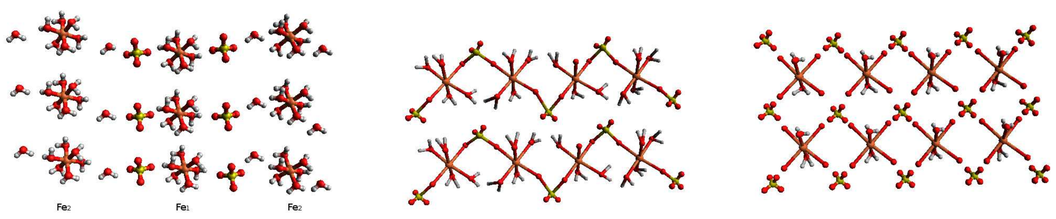
(a) (b)

Fig 1. Optical micrographs of (a) ferrous sulfate (Ferro-F-800®) and (b) ferrous fumarate (IOFI®).

The Mössbauer spectra obtained at 300 K and 77 K have been described by means of several quadrupolar doublets with lorentzian lines, assigned to HS Fe^{3+} and Fe^{2+} species.
The spectra were properly fitted by introducing doublets with symmetrical lorentzian lines.
In order to investigate in more detail the hydrated character, particularly of the ferrous sulfates, we collected 300 K Raman spectra for all medicines.

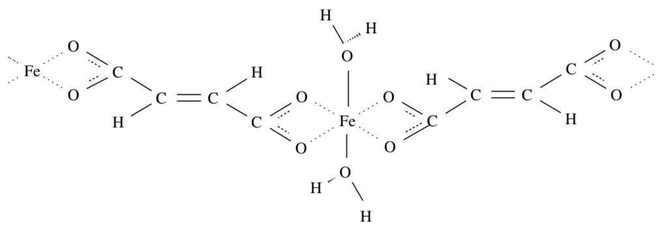
2. Structural models

Ferrous sulfates. Crystallographic structures of some *n*-hydrated ferrous sulfates [4].



From left to right: Melanterite ($7H_2O$), Rozenite ($4H_2O$) and Szomolnokite ($1H_2O$).

Ferrous fumarates. Molecular structure of ferrous fumarate [6].



3. Results and Discussion

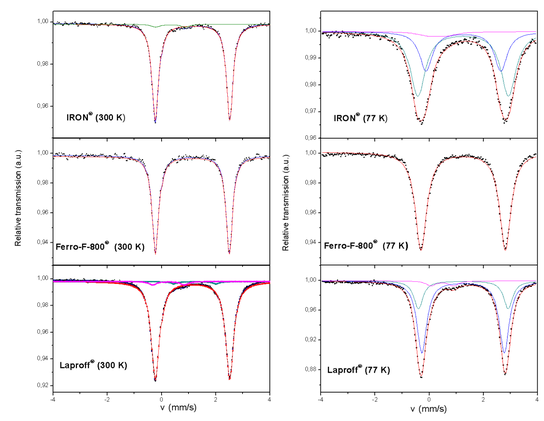


Figure 3: Room temperature (left) and 77 K (right) Mössbauer spectra of ferrous sulfates

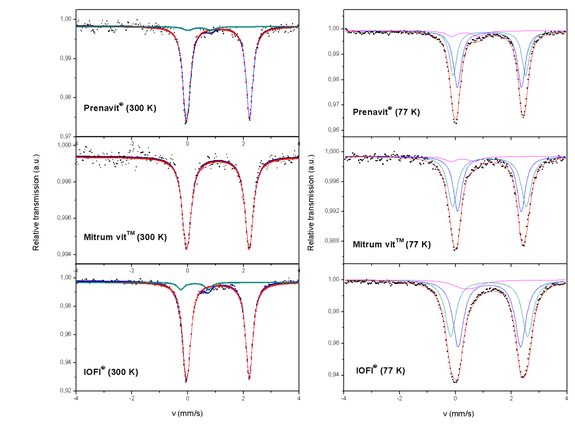


Figure 4: Room temperature (left) and 77 K (right) Mössbauer spectra of ferrous fumarates.

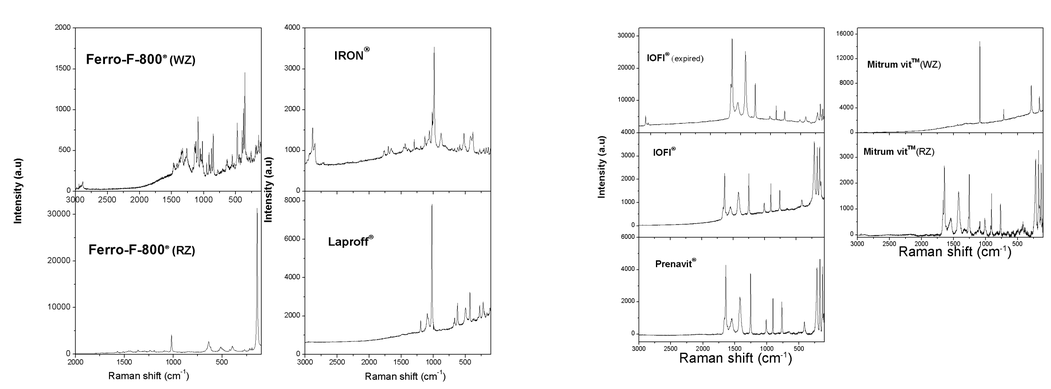


Figure 5: Room temperature Raman spectra for ferrous sulfates (left) and ferrous fumarates (right) containing medicines.

It is possible to see the Raman bands located at $\approx 796\text{cm}^{-1}$, $\approx 990\text{cm}^{-1}$, $\approx 1018\text{cm}^{-1}$ corresponding to $\nu_1 SO_4$ vibration modes of Melanterite, Szomolnokite and Rozenite respectively.

5. Conclusions

Six commercially available iron-bearing medicines have been investigates by means of Mössbauer and Raman spectrometry. The 300 K Mössbauer spectra of all medicines reveal the presence of a single Fe^{2+} species, while the description of 77 K spectra gives rise to two Fe^{2+} species in the case of five medicines, in addition to the existence of some minor Fe^{3+} contaminant. The physical origins of these two components were interpreted as due to the presence of several easily hydrated ferrous compounds: Szomolnokite and Rozenite, respectively. Only one medicine contains a single paramagnetic Fe^{2+} site at both 300K and 77 K, suggesting that its active part results from an homogeneous elaboration process by the manufacturers.

References

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