Magnetic nanoparticles: evaluation of toxicity using Artemia salina

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Introduction

Magnetic nanoparticles (MNP) are not new to the pharmaceutical and medical areas, as the first use date from the 70s. The MNP may be used in different applications on the health field such as in vitro separation, hyperthermia agents, contrast agents for magnetic resonance imaging (MRI) and drug targeting. It is important to evaluate the toxicity of the pharmaceutical preparations, in this sense the MNP were tested against Artemia salina to analyze their viability.

Materials and Methods

MNP were synthesized by the co-precipitation method, adding Fe²⁺ and Fe³⁺ ions into deionized water and then adjusting the pH until 8.4 using NaOH. For the toxicity essay, firstly, the A. salina dryed cysts were placed artificial seawater (NaCl 0.1 mol/L) and were let hatch under continuous illumination for at least 36 h at room temperature. The MNP stock solution (0.02 mol/L) was added in the concentrations of 2, 3, 4, 5, 10, 20, 30, 40 and 50% to A. salina larvae (from 10–15 on each well) and they were left resting in 12-wells plates for 30 min. After, it was counted the live/dead nauplii. It was also tested the physical mixtures of Fe²⁺/Fe³⁺ (FePM) in water and the NaOH aqueous solution used to prepare the MNP.

Results and Discussion

The A. salina toxicity test is an important screening methodology being cheap and presenting rapid results in testing the viability of the brine shrimp. Analyzing at Fig. 1, it is possible to observe that the viability of the brine shrimp is greater than 70% until a concentration of 50% (v/v) of MNP. An approximate value of viability is seen on the concentration of 2% (v/v) of FePM. When looking to the NaOH solution, with the lowest tested concentration (2%, v/v) the live cells are 37%. Probably, the FePM higher toxicity is due to their size in comparison with the MNP; while the FePM is composed of molecule sized components, the MNP are nanoparticles ranging from 10 to 100 nm.

The lethal doses of MNP and its constituents are displayed in Table 1. These results corroborate with the viability, where the LD50 of NaOH is smaller (0.76 ± 0.02 live nauplii/total nauplii) than the other samples. Proving that the MNP are less toxic than the material used to prepare them.

Table 1 – Lethal doses 50% (LD50) and 90% (LD90) of MNP, FePM and NaOH solution against A. salina.

<table>
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<tr>
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<th>MNP</th>
<th>FePM</th>
<th>NaOH Sol</th>
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<tbody>
<tr>
<td>LD50 (%)</td>
<td>88.65 ± 1.77</td>
<td>3.69 ± 0.07</td>
<td>0.76 ± 0.02</td>
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<tr>
<td>LD90 (%)</td>
<td>151.36 ± 6.05</td>
<td>8.76 ± 0.29</td>
<td>10.51 ± 0.11</td>
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</table>

Conclusion

MNP were less toxic to the A. salina than their constituents. Which is interesting to the continuity of the research with these MNP.

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References
