

phenomenon: the pH decrease of Pb^{2+} , Cd^{2+} , Hg^{2+} , and Zn^{2+} , which have 2 positive charges were about the same (0,36, 0,38, 0,43, and 0,48 unit pH respectively), while Ag^+ which has only one positive charge gave the smallest decrease in pH (0,10 unit), and Fe^{3+} which has 3 positive charges showed the biggest pH increased (2.13 unit pH). The amount of metals adsorbed/g straw in column experiments was by far larger than that of in the batch experiments because the amount of straw was increased and also the process was running continuously using a much larger volume of solution (200 ml compared to 15 L) even though the initial concentration was the same (20 ppm). In column competitive experiments the amount adsorbed of most metals dropped drastically, only Hg and Fe showed a small increase, in total, the amount of mg/g adsorbed and also the μmol metal adsorbed also dropped to about a half. The final pH also dropped drastically to 3.73 unit pH. In other study by Kohar *et al.* (1997) the adsorption of Pb and Cd in low pH was very low as well, whereas the optimum pH for Pb and Cd was at pH 5. Study on column experiments need to be explored in a more thorough research.

4. CONCLUSIONS

Rice straw was studied as adsorbent for the removal of different metal ions in solutions. The amount of metals adsorbed/g straw increased with the increase of initial concentrations of the metals and also with that of the straw. pH also played important role in the adsorption of heavy metals by straw, which showed that chemical reactions were occurred in the adsorption, even though there was also a possibility that the adsorption was going through physical adsorption. Competitive adsorption was occurred in mixed solution.

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