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Physico-mechanical characterization of polyurethane foam dressings containing natural polyols

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Advanced wound dressings are replaced traditional dressings in order to provide appropriate environment for healing and also to promote cell migration [1]. The key characteristics of wound dressings are non-toxic, highly absorbed, air permeable, biocompatible and have good mechanical properties [2]. Due to providing moist environment and also protecting maceration at the wound edge area, foam dressings are used in various clinical applications [3]. They are mostly prepared from polyurethane between polyols and isocyanate polymerization. In this study, natural polymers were added to improve hydrophilicity and absorption activity of polyurethane foam formulations. Their morphology, absorbing and mechanical profiles were investigated.

Polyurethane foam formulations consisting of 100 percent of polypropylene glycol (PPG, molecular weight 3000), toluene diisocyanate (TDI), deionized water, silicone surfactant, amine catalyst and tin catalyst were prepared with and without 2 percent of starch polymers, starch 1500 and corn starch as natural polymers with abundant polyols by high-speed stirring until a foam reaction occurred and air drying for 24 hours. The SEM appearance (Fig. 1A) revealed larger pore size of foams containing starches compared to that without natural polymer especially at the side view. Large molecular size with scattering hydroxyl groups of the investigated starches might cause pore enlargement during chemical reaction. Initially, all prepared foams had high rate of water absorption but the rate gradually and continuously decreased after 10 minutes (Fig. 1B). However, foams with corn starch seemed to dehydrate faster than other foams. The moisture vapor transmission rate of that without natural polymer was higher than those with starches at all-time points. The tensile strength, percentage of elongation and elastic modulus results of the latter formulations were higher than those from the former. Moreover, in compression profiles, the stress at 25, 50 and 75 percent strain of starch 1500 foam was lower than those from foams with corn starch and without starch. From our preliminary study, starch 1500

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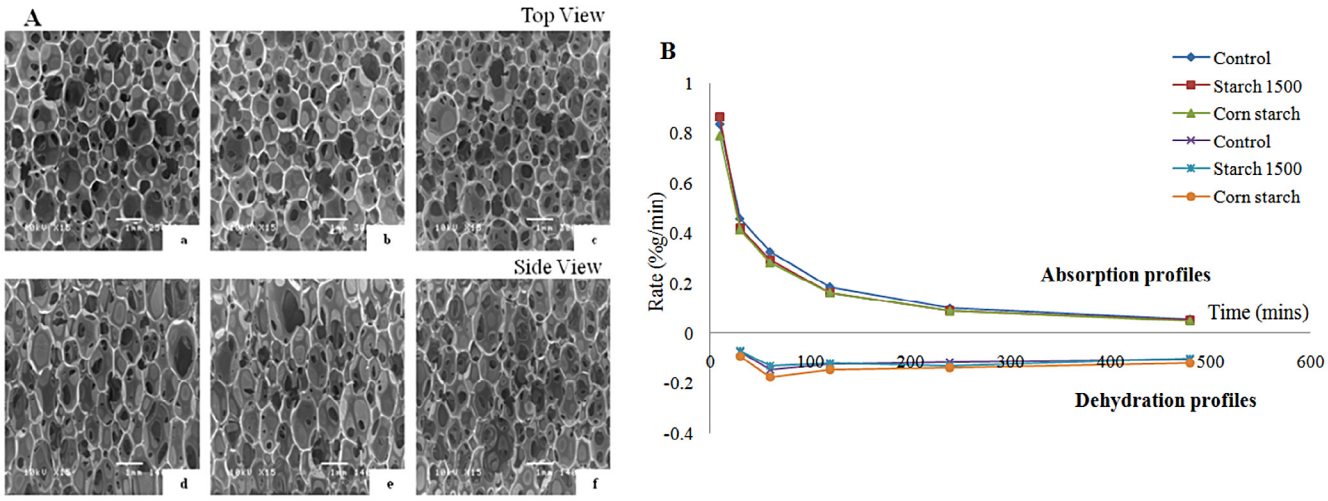

Fig. 1 – SEM photographs of without natural polymer, starch 1500 and corn starch foams (a, b and c, top view; d, e and f, side view, respectively) (A) and Absorption and dehydration profiles of without natural polymer (control), starch 1500 and corn starch foams (n = 9) (B).

may be good alternative to improve polyurethane foam characteristics due to initial high absorption rate and low dehydration rate. The appropriate concentration of natural polyols and their properties should be further investigated.

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