CHAPTER V

CONCLUSION AND SUGGESTION

5.1 Conclusion

The preparation of foams from starch/natural rubber blends could be concluded as follows:

1. The foaming process of the mixtures of starch/water and starch/NR could successfully be carried out. The mixtures were heated and stirred at 70°C for 15-20 min. The mixtures obtained, which are a high viscosity substance due to the gelatinization of starch, are subjected to the hot mold and pressed. The temperature and the pressure used for the foaming process were 130-180°C and 50-110 $kg_f cm^{-2}$.
2. The level of water in the range of 150-200% by weight of the dry starch could give a good condition of foaming. The good condition of foaming is defined here by the foams obtained that have the uniform closed cell structure. If the water content were lower than 150%, the condition of the foam was poor. Because the lower steam could not cause the starch to foam. On the other hand, if the water content exceeded 200%, it produced the higher water steam and the cells of the foam were non-uniform

3. Since the temperature of the blending caused the coagulation of the NR latex, the NR could not be dispersed in the gelatinize starch. To stabilize the NR, Nonidet P40, a non-ionic surfactant, was used. The suitable amount of Nonidet P40 was 1.5% by weight of the NR latex.
4. The maximum loading of NR latex was found to be 50% by weight of the dry starch. If the content of NR was higher than 50% it would inhibit the gelatinization and consequently starch/NR blend could not be prepared foam by this process.
5. The storage modulus of the foams increased with increasing NR content, due to the high elasticity of the NR component and its promotion of more elasticity to the foams. The significant increase in the storage modulus was found when 2-5% of benzoyl peroxide by weight of NR was added to the blends. The crosslinked natural rubber contributed to further increases in storage moduli.
6. The compressive strength of the foam was increased by 42-233% compare to the starch foam, when the NR content increased 10-50% by weight of the dry satrch. Addition of 2-5% benzoyl peroxide by weight of the NR distributed to increased the compressive strength by 20-118% compare to the foam without benzoyl peroxide.
7. Calcium carbonate can be added to the starch/NR blend in the range of 5-30%. The compressive strength and the storage modulus of the foams increased with increasing content of calcium carbonate when its content was higher than 5%. Likewise, the hardness and brittleness of the foams of the foams also increased.

5.2 Suggestion for Further Work.

1. An extruder or internal mixer should be used to blend starch/NR to provide a high degree of shear mixing. A more homogeneous starch/NR blend should be obtained.
2. Effect of the degree of gelatinized starch to the foaming process should be further studied.
3. Other types of blowing agent, in addition to water, should be added to the polymer blend for a foaming process.
4. Other reinforcing agent or substance, such as fibers, could be incorporated to the blend to enhance the strength of the foam.
5. Other crosslink agent, such as sulphur, or sulphur donor, or other ways to promote the crosslinking reaction of NR such as the use of prevulcanized latex should be tried.
6. Since mechanical, optical, and thermal properties of the foam depend on cell size, the cell size should be characterized by measurements of cell diameter and average cell volume via an image analysis of the SEM microscope.
7. Since the blend of the two polymers is said to be a biodegradable, the degradation of this foamed material should be studied.