

CHAPTER VII

CONCLUSIONS AND RECOMMENDATIONS

The success work is the first time of producing the TPV from natural rubber, biodegradable polymer, and fluoropolymer via dynamic vulcanization technique. This TPV aims to replace the fluoro rubber for the application of automotive rubber parts used in fuel system. DBPH is the best vulcanizing agent in this mixing system compare to sulfur and DCP. It provides the highest mechanical properties and the lowest degree of swelling. The NR/PVDF/PHBV TPV can improve the compatibility by adding the biocompatibilizer such ESO. The incorporation of ESO can improve the compatibility of all materials and effect to the vulcanization reaction. At small amount of ESO below 5 phr, ESO behaves like a plasticizer that reduces the viscosity of the blend, low vulcanization occur, and let to reduce mechanical properties and oil swelling resistance, but increase processability. In the other hands, ESO behaves like a compatibilizer at the higher content above 5 phr and the function of plasticization still remains. The compatible ESO helps dynamic vulcanization to be better by providing the good morphology of rubber particles with the small size around 1 micron disperse in the thermoplastic blend between PVDF and PHBV. The ESO can improve the mechanical properties and oil swelling resistance of TPV, which near the FKM commercial rubber parts, at the amount of ESO over 5 phr and 10 phr is the best for using in the long time.

If consider on the cost of raw materials for producing rubber parts from this TPV with the commercial rubber parts which is fluoro rubber (FKM), the TPV has the very low cost compare to the commercial one that can be shown in Table 7.1.

Table 7.1 Comparison of raw material costs for producing rubber part between the TPV and the commercial.

Raw Materials	Cost (Baht)		
	Per 1 kg	TPV	Commercial rubber
NR, STR 5L	100	50	-
PVDF, J100	500	200	-
PHBV, Y1000P	240	24	
FKM, Viton GF600S	2,300	-	2,300
Sum		274	2,300

As see in Table 7.1, the raw materials cost of rubber parts produce from TPV is much more lower than FKM. So, it is reasonable to compensate the very expensive FKM commercial rubber part with TPV. It saves more and gives an opportunity for the old car to use the cheap biofuel with more safe. These also help people to reduce global warming.

There are many factors that cannot investigate in this study such as the crosslink density of fully vulcanized NR, PVDF, all TPVs for all vulcanization systems; the cure characteristic and thermal properties of non-vulcanized TPV incorporated with different amount of ESO. Some properties should be study such as the impact strength and compression set and all mechanical properties should be done after aging and ozone test. The study of varying ESO content, each amount of ESO should be far away from each other, the varied contents of ESO were too close in this study. All of these should be further studied.