

CHAPTER V

CONCLUSIONS AND SUGGESTION

Photooxidative degradation of natural rubber by titanium dioxide under UV light was studied. The extent of degradation of unvulcanized natural rubber in solution phase is varied as a function of UV exposure time and the content of TiO₂ under accelerated condition. FT-IR spectrum of degraded natural rubber solution showed a peak corresponding to carbonyl group indicating that a decay of molecular weight is as a consequence of photo-oxidative degradation. The extent of degradation of natural rubber in solid phase (both unvulcanized and vulcanized sheets) is proportional to UV exposure time. Unlike the degradation of natural rubber in solution phase, the degradation of natural rubber in solid phase is inversely proportional to the amount of TiO₂ incorporated. The higher content of TiO₂ added, the greater stability against degradation of natural rubber is observed. This outcome suggests that TiO₂ plays a major role as a stabilizer rather than a sensitizer. As demonstrated by SEM and particle size analyses, TiO₂ tended to aggregate into larger particles having a diameter of 1-2 μm which can reflect the UV light ($\lambda \sim 0.29 - 0.32 \mu\text{m}$). As a consequence of particle agglomeration, the interfacial area between TiO₂ and rubber matrix is reduced, causing the lower photocatalytic efficiency. The appearance of surface fracture of both unvulcanized and vulcanized natural rubber sheets implied that the degradation of natural rubber in solid phase do not predominantly occur at the interface between TiO₂ and natural rubber matrix. This research study strongly suggests that the distribution of TiO₂ throughout the matrix is a key factor in controlling the degradation and stability of natural rubber. Although the degradation of natural rubber cannot be successfully controlled by TiO₂ incorporation, TiO₂ can be used as a nontoxic agent that can effectively enhance the natural rubber stability against the photo-oxidative degradation.

To achieve sensitizing role of TiO₂ as well as to improve an efficiency of photo-catalytic degradation of natural rubber in solid phase, it is necessary to prevent

TiO₂ from agglomeration when being incorporated in natural rubber matrix. Another alternative is to use TiO₂ having the size in nanometer that can be distributed well in order to increase the interfacial area between TiO₂ and the natural rubber matrix, and thereby enhancing the extent of photooxidative degradation.



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