Utilization of tannery solid wastes especially chrome shavings and trimmings, has become a necessity for leather manufacturers. It serves partly as a measure of improving the value of the raw material and partly to implement the growing environmental regulations. Though various recycling processes have been suggested in the past, only a few of them are in commercial practice. Efforts are being made continuously to seek more efficient methods to utilize these fibrous materials. The work reported in the previous chapters is such an attempt to utilize the chrome shavings in elastomer compositions. As leather itself is a polymer which is highly polar and cohesive, NBR and NBR/PVC blends have been used in this work as matrix materials in order to ensure a degree of compatibility.

When leather fibers are used in elastomer matrices, the first important consideration is the vulcanization temperature. As a biopolymer, leather would undergo denaturation during vulcanization at high temperatures. In addition to the degradation products of leather, presence of chromium would affect the vulcanization characteristics of the matrix. In this context, the effect of temperature on the vulcanization characteristics of NBR and NBR/PVC blends filled with the leather fibers have been studied. The results have shown that the use of leather shavings without prior neutralization has a deteriorating effect on the matrix. However, efficient vulcanization has been realized for NBR and NBR/PVC blends filled with short leather fibers obtained from suitably neutralized chrome shavings. Among the differently treated leather fibers, ammonia treated fibers have imparted maximum torque values to the blends without considerable reversion at high temperatures. Though reversion has been
observed at high temperatures for compounds containing sodium hydroxide treated leather fibers, the optimum cure times are far lower than the reversion time. It is thus possible to vulcanize and produce composites based on NBR and NBR/PVC blends filled with suitably neutralized leather fibers.

Addition of short fibers in elastomer compositions is generally associated with an increase in the modulus, tear strength and a reduction in elongation at break values. Leather fibers also behave in a similar manner when used in elastomer composites. Improved mechanical properties are obtained with NBR/PVC blends filled with ammonia treated leather fibers. As the fiber loading increases, failure of the composite occurs in a brittle manner. NBR/PVC blend with high Mooney viscosity and 70/30 composition has been found to be a suitable matrix for leather fibers. As with other synthetic and natural short fibers, leather fibers are also found to exhibit an optimum loading. Beyond 30 parts by weight the mechanical properties start declining. Electron Micrographs have shown diffused interface between the matrix and the fibers.

Thermal stabilities of the composites filled with leather fibers fall in between that of the pure components. Composites based on NBR have shown higher thermal stability due to the tightly crosslinked structure of NBR. In NBR/PVC blends, degradation of PVC at high temperatures results in lower thermal resistance. Vulcanizates filled with untreated leather fibers and sodium hydroxide treated leather fibers have exhibited extensive degradation. Dynamic Mechanical analysis of NBR composites containing leather fibers has shown little change in the glass transition temperature of the matrix. However, the tan δ values of the composites have been considerably reduced. Storage modulus values of NBR composites containing leather fibers are significantly higher when compared to the silica filled vulcanizate suggesting the rigidity imparted to the composites by leather fibers.
NBR and NBR/PVC-Leather composites have shown improved swelling resistance when compared with the individual constituents in their respective media. While the leather fibers restrict swelling of the polymer matrix in MEK, the matrix restricts the swelling of leather in aqueous media. This synergism in swelling might be due to the interfacial adhesion between the leather fibers and the matrix. The improved adhesion between the matrix and the fibers has further been supported by the reduction in swelling of the composites in MEK upon the increase of leather loading. Swelling studies reveal that these materials could be used in footwear applications where controlled transport of water is essential for long duration.

SUGGESTIONS FOR FUTURE WORK

Leather fibers used in this work were neutralized with common bases with a view to keep the process as simple as possible. However, if mild bases based on organic compounds such as amines are used, improved adhesion between the leather fibers and the matrix might result in addition to neutralization. Such treatments would serve the purpose of bonding systems used in other short fiber reinforcements. Leather fibers treated in this way coupled with suitable vulcanizing system might result in improved mechanical properties with NBR and NBR/PVC blends. Though a reduction in particle size and the associated increase in surface area would result in improved reinforcement, an increase in contact points between the constituents might cause extensive degradation to the matrix. Hence, the effect of surface area on the possible degradation of the matrix might be studied. In addition to this, treatments which would remove chromium from the shavings could prevent matrix degradation considerably. If the shavings are to be used as such without any pretreatment, it is worth to investigate the properties of leather composites based on reclaimed rubber. In this process it may be possible to integrate the recycling processes of both reclaimed rubber and the chrome containing tannery wastes.