

# THE CURRENT STATUS OF SULPHUR VULCANIZATION AND DEVULCANIZATION CHEMISTRY: DEVULCANIZATION

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The article presents the final part of the review on the current status of sulphur vulcanization and devulcanization chemistry. Though considerable scientific attention has been given to study and understand the sulphur vulcanization process and the reaction mechanisms involved, it is doubtful whether an equivalent effort has been made to understand the reaction mechanisms involved in reclamation/devulcanization processes. The present review focuses on the current understanding of the chemical reactions and the proposed underlying mechanisms of different devulcanization processes after providing a bird's eye view of the whole used rubber products management scenario. The various devulcanization processes are discussed under headings *viz.* chemical/ thermo-chemical devulcanization, thermo-mechanical/mechanical devulcanization, mechano-chemical devulcanization, microwave devulcanization, ultrasonic devulcanization and biological/ biotechnological devulcanization. The revulcanizate properties of the devulcanized samples by various processes are also discussed.

**Keywords:** Devulcanization, reclamation, recycling, revulcanizate properties

## INTRODUCTION

Utilization and disposal of used tyres represent an enormous challenge to industrialized countries worldwide because of their three dimensional-crosslinked-structure which renders them non-biodegradable, raising serious disposal concerns (Synder, 1998; Dierkes, 1996; Gou *et al.*, 2010; Klingensmith and Rodgers, 1994; Reschner, 2008). It is estimated that about 300 million scrap tyres are generated in US annually, a situation that is mirrored in countries round the world in various proportions. The most obvious hazard associated with the uncontrolled disposal

and accumulation of large number of tyres is the potential for large fires which are extremely detrimental to the environment. Even if large outside tyre piles do not catch fire, they still pose a serious problem for human health and the environment by being an ideal breeding ground for mosquitoes.

The various stages in the life cycle of tyres are presented in Figure 1. In response to the environmental problems and health hazards caused by countless illegal scrap tyre piles around the globe, most developed countries have developed legal guidelines addressing this issue. These legislations to ensure environmental safety, resulted in