[0014] Thus, the state of the art still lacks a process for recycling elastomers that doesn't require the use of high temperatures, special equipment and compatibilizing agents, and that covers a variety of elastomers, regardless of their original vulcanization/crosslinking processes, thus allowing the use of large quantities of recycled material in the manufacture of articles and, depending on the article to be formulated, even using 100% of the recycled elastomer.

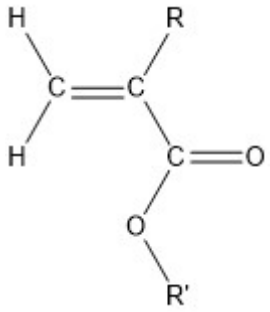
[0015] As will be more fully detailed below, the present invention aims to solve the problems of the state of the art described above in a practical and efficient way.

SUMMARY

[0016] The present disclosure relates to a process for recycling solid elastomer waste without the use of high temperatures, special equipment and compatibilizing agents. More specifically, the present disclosure envisages a process comprising radical de-crosslinking conducted in the presence of ozone and a de-crosslinking agent in a solvent medium, as well as the recycled elastomer thus obtained.

[0016a] In one aspect, the present disclosure relates to a process for recycling elastomer waste, characterized by the fact that it comprises: 1) dissolve a de-crosslinking agent in a solvent and add the solution thus formed to the elastomer wastes, where the de-crosslinking agent is selected from peroxides, persulphates or similar or mixtures thereof; 2) promote stirring followed by rest; 3) add water; and 4) add ozone, where the solvent is toluene and/or xylene, peroxides are selected from the group consisting of benzoyl peroxide, dicumyl peroxide, oxybisperoxides and the like, or mixtures thereof, persulphates are selected from the group consisting of ammonium persulphate, potassium persulphate, sodium persulphate and the like, or mixtures thereof, and where, in step 4), ozone is bubbled for a period of time between 4 hours and 6 hours at a flow rate of 30 mg/L to 50 mg/L.

[0016b] In another aspect, the present disclosure relates to a process for recycling elastomer wastes, characterized by the fact that it comprises: 1) preparing a solution comprising water, a surfactant and a de-crosslinking agent and adding the solution formed to the elastomer residues, where the de-crosslinking agent is a "reactive solvent"; 2) promoting stirring followed by rest; and 3) adding ozone, wherein the surfactant is selected from the group consisting of sodium lauryl ether sulfate and ethoxylated or similar nonylphenols or mixtures thereof, the "reactive solvent" consists of compounds selected from the group of acrylates or methacrylates represented by the formula (I), styrene, divinylbenzene and the like, or mixtures thereof



where R is hydrogen or CH_3 and R' is an alkyl group of 1 to 4 carbons, and where, in step 3), ozone is bubbled for a period of time between 4 hours and 6 hours at a flow rate of 30 mg/L to 50 mg/L.

[0017] The present disclosure also relates to the recycled elastomers obtained through the aforementioned process and their use in the manufacture of articles comprising them.

[0017a] In another aspect, the present disclosure relates to a recycled elastomer, characterized by the fact that it is obtained by the process as defined herein.

[0017b] In another aspect, the present disclosure relates to use of the recycled elastomer obtained by the process as defined herein, characterized by the fact that it replaces the part of the raw material comprising virgin elastomers

for making articles.

[0018] The purpose of the present disclosure is to provide a processing route for the chemical recycling of elastomers without decomposing the polymeric material. Therefore, it is also an object of the present disclosure to obtain recycled elastomers capable of significantly replacing virgin elastomer in compositions of new articles based on vulcanized rubber. In this context, this disclosure envisages the use of large quantities of the recycled elastomer obtained by the proposed process or even the manufacture of articles exclusively from recycled elastomers.

[0019] The aforementioned purposes and other advantages of the

present disclosure will become clearer from the following description.

BRIEF DESCRIPTION OF THE FIGURES

[0020] Figure 1 illustrates a radical formation route with benzoyl peroxide in the presence of ozone.

[0021] Figure 2 illustrates a radical formation route with a persulphate in the presence of ozone.

[0022] Figure 3 illustrates a radical formation route with styrene in the presence of ozone.

[0023] Figure 4 illustrates specimens consisting of virgin SBR and a blend of 30% by weight of virgin SBR with 70% by weight of recycled SBR.

DETAILED DESCRIPTION OF THE INVENTION

[0024] The present invention relates to the chemical recycling of solid elastomers waste conducted at room temperature and in the presence of ozone and a de-crosslinking agent in a solvent medium.

[0025] More specifically, and unlike the existing state of the art, the present invention makes combined use of de-crosslinking agents and ozone as an initiator for the formation of free radicals in said de-crosslinking agent. These radicals attack the cross-links in the polymer matrix and thus promote its de-crosslink. In this context, ozone acts concomitantly in the process of de-crosslinking elastomers.

[0026] According to the present invention, the aforesaid de-crosslinking agent consists of a peroxide, a persulphate or mixtures of these or similar or, alternatively, a "reactive solvent".

[0027] Peroxides, for example, have a half-life (the time it takes for half the amount of mass to decompose at the operating temperature). In conventional processes of the art, based on the formation of radicals in peroxides at high temperatures, the concentration of radicals formed decreases due to the thermal decomposition of the peroxide. In this scenario, the formation of radicals in the presence of ozone becomes more efficient as it