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PROCESS FOR PRODUCING SULPHUR DIOXIDE-OLEFIN RESINS

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This invention relates to resins of the sulphur dioxide-olefin type and to a new and improved process for producing them.

It has long been known that resinous polymerization products may be produced under proper conditions by the reaction of sulphur dioxide with active unsaturated organic compounds of the olefin type, of which the mono-olefins like ethylene, propylene, butene-1, butene-2, isobutene, pentene-1 and pentene-2 are examples. Other examples of such unsaturated compounds are butadiene, pentadiene and other conjugated diolefins; pentyne-1, hexyne-1 and other acetylenes; and poly-functional unsaturated compounds of the nature of allyl alcohol, vinyl acetate and allyl propionate. This reaction, however, takes place to a substantial extent only under the influence of catalysts. When carried out properly in the presence of a satisfactory catalyst, the reaction produces thermoplastic resins that are valuable for use in the manufacture of molded objects, as bases for lacquers, varnishes, etc., and for other purposes to which plastics are ordinarily applied.

The commercial development of resins of the sulphur dioxide-olefin type has been retarded by the lack of sufficiently active catalysts. Light of the proper wave length, oxidizing compounds such as certain peroxides and silver nitrate, and certain organometallic compounds have been disclosed heretofore as suitable catalytic agents. The known processes involve the reactor of sulphur dioxide and an active unsaturated organic compound, in a sealed glass tube or steel bomb, at comparatively low temperatures and in the presence of sunlight or another of these known catalysts. None of these catalysts, however, is capable of converting the reactants into the desired resinous product in an economically feasible period of time, many hours and even days being required to obtain a satisfactory yield, and in many cases resins are produced which are contaminated or discolored by the catalyst.

One of the objects of our invention is to secure a higher yield of resin than has heretofore been possible in the reaction between sulphur dioxide and unsaturated compounds of the olefin type by providing an exceedingly active catalyst for the reaction.

Another object of our invention is to provide a catalyst for the reaction which results in a high yield of resin within a very short period of time as compared with prior processes, periods of an hour or less being required in accordance with this invention, instead of hours or days.

Another object is to provide a catalyst which is more stable and safer to use than many substances heretofore proposed and which is not liable to undergo explosive decomposition.

A further object of the invention is to provide a catalyst which can be made easily and which avoids the use of low temperatures and solvents in its preparation.

Still another object of our invention is to provide an improved process for producing resins of the sulphur dioxide-olefin type, a catalyst being used in this process which has no contaminating or discoloring effect on the resin product, so that new products having superior qualities for molding and other purposes may be obtained.

Other objects and advantages of the invention may become apparent from the following description.

According to the invention of Maxwell M. Barnett, as disclosed in a copending application, Serial No. 254,381, filed February 3, 1939, the production of sulphur dioxide-olefin resins is carried out by reacting sulphur dioxide with unsaturated organic compounds in the presence of active ozonides as catalysts, particularly an ozonide that has been prepared under anhydrous conditions. In that process several of the objects of the present invention are realized, but disadvantages have been encountered due to the fact that the ozonide catalysts, in general, must be prepared at very low temperatures and extreme care must be exercised in handling and using them because they are so unstable as to be dangerous. For example, the ozonides of ethylene and acrolein are so unstable that they are spontaneously explosive and are sensitive to slight shocks or rises in temperature. The ozonides of butene-1 and butene-2 are useful catalysts, but these materials must be prepared at relatively low temperatures, and, while they are not spontaneously explosive, a slight shock or elevation of temperature is sometimes sufficient to cause detonation.

It has been supposed that the catalytic activity of the ozonides is proportional to the quantity of oxygen contained in the molecule. We have now found, however, that in the case of diisobutylene ozonide the catalytic activity is considerably greater than would be indicated by comparing the quantity of active oxygen in the molecule with the quantity of active oxygen in the molecule of other catalytically active ozonides. We have also found that diisobutylene ozonide is quite stable in comparison with other ozonides and is not liable to undergo explosive decomposition. Thus,