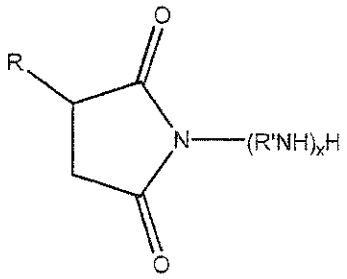
Molybdenum succinimide complexes are also described in U.S. Patent Application Publication No. 2009/0325832. These complexes are prepared by a process comprising (a) reacting an alkyl or alkenyl succinimide of a polyamine, with an ethylenically unsaturated carboxylic acid or anhydride thereof; and (b) reacting the product of step (a) with an acidic molybdenum compound. Also disclosed is a lubricating oil composition containing at least (a) a major amount of a base oil of lubricating viscosity and (b) a minor amount of the molybdated succinimide complex.

It is desirable in certain applications (e.g. wear inhibition, oxidation control, and friction performance) for additives to contain a high concentration of molybdenum and basic nitrogen, in addition to other physical and handling properties such as being lower in color intensity. Also desirable is a process which does not result in particulate matter in the final product.

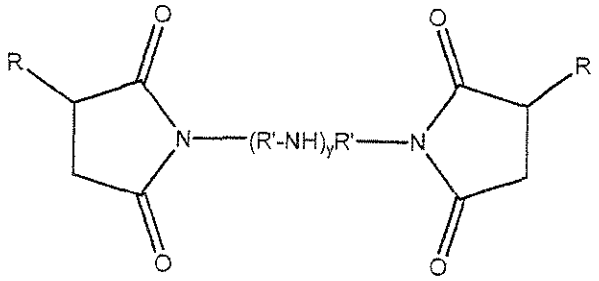
SUMMARY OF THE DISCLOSURE~~INVENTION~~

In accordance with one embodiment of the present disclosure~~invention~~, there is provided a process for preparing a molybdated succinimide complex, the process comprising:

(a) reacting an alkyl or alkenyl succinimide of a polyamine of formula I, or formula II or mixtures thereof:



Formula (I)



Formula (II)

wherein R is an about C_{12} to C_{30} alkyl or alkenyl group, R' is a straight or branched-chain alkylene group having 2 to 3 carbon atoms, x is 1 to 11, and y is 1 to 10, with an α,β-unsaturated mono-carboxylic acid or carboxylic acid ester, in a charge mole ratio of the α,β-unsaturated mono-carboxylic acid or carboxylic acid ester to the succinimide of formula I or formula II or mixtures thereof of about 0.1:1 to about 6:1, and wherein the reaction temperature is no greater than about 135°C; and

(b) reacting the succinimide product of step (a) with an acidic molybdenum compound,

wherein the molybdated succinimide complex prepared is a liquid at room temperature.

Among other factors, the present disclosure~~invention~~ is based on the surprising discovery of an improved process for the preparation of molybdated succinimide complexes. It has been found that molybdenum succinimide complexes derived from low molecular weight alkyl or alkenyl succinimides where the amine portion of the molecule has been post-treated with an α,β-unsaturated mono-carboxylic acid or carboxylic acid ester results in a product that is a liquid at room temperature, and results in a product with no visible particulate matter.

Another advantage of the present process is that the reaction of an alkyl or alkenyl succinimide of a polyamine with an α,β-unsaturated mono-carboxylic acid or carboxylic acid ester is carried out at a temperature no greater than about 135°C.

The post-treatment with an α,β-unsaturated mono-carboxylic acid or carboxylic acid ester at no greater than about 135°C, compared to the use of maleic anhydride at temperatures as high as 160°C, advantageously allows for a product which has an increased amount of molybdenum, improved Total Basic Nitrogen (TBN), improved wear performance, and more desirable physical and handling properties (such as a lower pour point). The resulting product