have at least one or several disadvantages including poor processing properties, insufficient oxygen uptake, moisture or UV-Vis activation requirements and most of them also suffer from poor clarity and lack of recyclability.

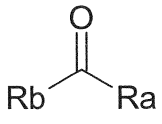
A need exists for improved oxygen barrier compositions, methods for the production of said compositions and methods of using the compositions in packaging articles that satisfy all the demands as recited above, specifically the need for transparent, recyclable, thin walled articles and containers with excellent barrier capabilities, which do not depend on the presence of water for activation. In particular, it would be desirable to obtain improved gas barrier POs compositions that can be blown or cast as film or sheet or extrusion blow molded as monolayer containers with reduced haze and without any further activation mean required. This is particularly required for containers that need a long(er) shelf life, such as fresh and processed meat and other oxygen sensitive materials.

Summary

In one aspect, the present disclosure provides a use of an additive as oxygen barrier in a plastic material wherein

(a) the plastic material is a polyolefin, a polyolefin copolymer or a polystyrene, and the additive is (b) and optionally (c) wherein:

(b) is a compound of formula (I);



(I)

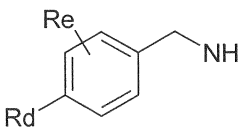
wherein

Ra represents C_7-C_{20} alkyl, C_6-C_{10} aryl, C_4-C_{10} heteroaryl, wherein the heteroatoms are N, O and/or S, (C_2-C_6)-alkenylen-(C_6-C_{10}) aryl,

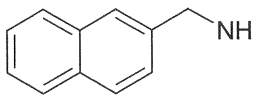
C_1-C_6-alkylen-C_6-C_{10}-aryl, the aryl and heteroaryl radicals optionally being substituted by:

hydroxyl, C_1-C_6-alkyl, C_1-C_6 alkoxyl, C_6-C_{10} aryloxy, halogen, cyano, nitro, C_6-C_{10}-aryl, di(C_1-C_6)alkylamino, (C_1-C_6)alkylthio, C_6-C_{10}-arylthio, =O, =S, SO_3H, $SO_2NR^1R^2$, CO_2R^3, $CONR^1R^2$, $NHCOR^4$, CO-C_6-C_{10}-aryl or a combination thereof, wherein R^1, R^2, R^3, R^4 are the same or different and independently represent hydrogen or C_1-C_6-alkyl;

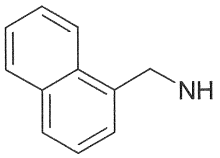
Rb represents a group selected from the moieties of formula (II), (III), (IV), (V), (VI) and (VII);



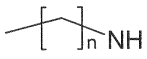
(II)



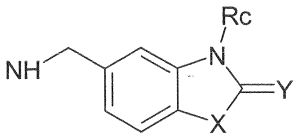
(III)



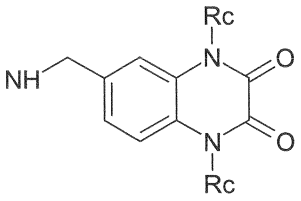
(IV)



(V)



(VI)



(VII)

wherein each

Rc can be the same or different and independently represents hydrogen, C_1-C_{20} alkyl or C_6-C_{10}-aryl, (C_2-C_4) alkenylen (C_6-C_{10}) aryl, C_1-C_4-alkylen-C_6-C_{10}-aryl, the aryl radicals optionally being substituted by hydroxyl, C_1-C_4-alkyl, C_1-C_4 alkoxyl, C_6-C_{10} aryloxy, Cl, cyano, C_6-C_{10}-aryl, or CO-C_6-C_{10}-aryl;

Rd represents hydrogen, $C_{1\text{-}30}$ alkyl, C_6-C_{10}-aryl or halogen;

Re represents hydrogen, $C_{1\text{-}30}$ alkyl, C_6-C_{10}-aryl or a halogen and can be on ortho (o) or meta (m) position to Rd;

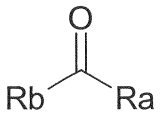
X can be O or N-Rf where Rf represents hydrogen, C_1-C_{20} alkyl or phenyl;

Y can be O or S;

n is a number from 1 to 30;

(c) is a transition metal catalyst.

In another aspect, the present disclosure provides a composition Z comprising the components A, B, and optionally C, the component A being a plastic material selected from the group consisting of polyolefins, polyolefin copolymers and polystyrenes; the component B being an additive selected from the compounds represented by the formula (I);



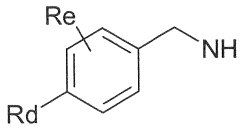
(I)

wherein

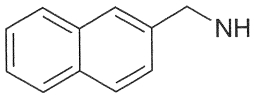
Ra represents C_7-C_{20} alkyl, C_6-C_{10} aryl, C_4-C_{10} heteroaryl, wherein the heteroatoms are N, O and/or S, (C_2-C_6)-alkenylen-(C_6-C_{10}) aryl, C_1-C_6-alkylen-C_6-C_{10}-aryl, the aryl and heteroaryl radicals optionally being substituted by:

hydroxyl, C_1-C_6-alkyl, C_1-C_6 alkoxyl, C_6-C_{10} aryloxy, halogen, cyano, nitro, C_6-C_{10}-aryl, di(C_1-C_6)alkylamino, (C_1-C_6)alkylthio, C_6-C_{10}-arylthio, =O, =S, SO_3H, $SO_2NR^1R^2$, CO_2R^3, $CONR^1R^2$, $NHCOR^4$, CO-C_6-C_{10}-aryl or a combination thereof, wherein R^1, R^2, R^3, R^4 are the same or different and independently represent hydrogen or C_1-C_6-alkyl;

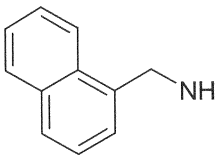
Rb represents a group selected from the moieties of formula (II), (III), (IV), (V), (VI) and (VII);



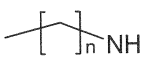
(II)



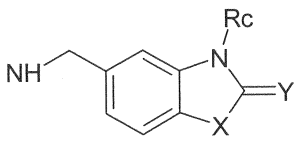
(III)



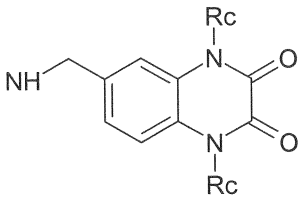
(IV)



(V)



(VI)



(VII)

wherein each

Rc can be the same or different and independently represents hydrogen, C_1-C_{20} alkyl or C_6-C_{10}-aryl, (C_2-C_4) alkenylen (C_6-C_{10}) aryl, C_1-C_4-alkylen-C_6-C_{10}-aryl, the aryl radicals optionally being substituted by hydroxyl, C_1-C_4-alkyl, C_1-C_4 alkoxyl, C_6-C_{10} aryloxy, Cl, cyano, C_6-C_{10}-aryl, or CO-C_6-C_{10}-aryl;

Rd represents hydrogen, $C_{1\text{-}30}$ alkyl, C_6-C_{10}-aryl or halogen;

Re represents hydrogen, $C_{1\text{-}30}$ alkyl, C_6-C_{10}-aryl or a halogen and can be on ortho (o) or meta (m) position to Rd;

X can be O or N-Rf where Rf represents hydrogen, C_1-C_{20} alkyl or phenyl;

Y can be O or S;

n is a number from 1 to 30;

the component C being a transition metal catalyst.

In another aspect, the present disclosure provides a method for the manufacture of a composition Z as disclosed herein, characterised in that the components A, B, optionally C, and optionally D, are physically mixed with one another.

In a further aspect, the present disclosure provides a formed plastic article comprising the composition Z as disclosed herein.

Detailed Disclosure of Embodiments

Within the scope of the present invention, preferred compositions would comprise an active oxygen barrier that absorbs oxygen at a rate faster than the permeability of oxygen through the packaging wall for the planned shelf life of the packaged product. Additionally, shelf life requirements for certain products impose that the oxygen barrier activity should be maintained for extended periods of time.

Surprisingly, it has been found that the object of the invention can be achieved by using particular additives as oxygen barriers in certain plastic materials and even more surprisingly also without the need for a transition metal catalyst as specified hereinafter.

Therefore, the present invention provides for the use of an additive as oxygen barrier in a plastic material wherein

a) the plastic material is a polyolefin, a polyolefin copolymer or a polystyrene, and the additive is (b) and optionally (c):

b) a compound of formula (I);