It is therefore an object of the present invention to provide a gelling radiation curable ink composition that provides high gloss images.

Summary

The object of the present disclosure is achieved in a radiation-curable inkjet ink composition comprising a radiation curable component, the radiation-curable inkjet ink composition further comprising an ester compound, the ester compound consisting essentially of a condensation product of a first reactant and a second reactant, wherein the first reactant is a compound A comprising at least 3 first functional groups, and wherein the second reactant comprises at least one compound B, wherein the at least one compound B comprises a second functional group, wherein the first functional group is a first group selected from a hydroxyl functional group and a carboxylic acid functional group and the second functional group is a second group selected from a hydroxyl functional group and a carboxylic acid functional group, wherein the first functional group is different from the second functional group and wherein the ester compound is present in an amount of 0.3 wt% - 3.0 wt% based on the total weight of the radiation-curable inkjet ink composition .

Radiation curable medium

The radiation curable inkjet ink composition may comprise a radiation curable medium. The radiation curable medium may comprise at least one radiation curable component. A radiation curable component is a component that may react (e.g. polymerize) under influence of suitable radiation, such as electromagnetic radiation, e.g. ultraviolet (UV) radiation. Examples of radiation curable components are epoxides and (meth)acrylates. (Meth-)acrylates may comprise one or more reactive groups for forming an acrylate polymer. The radiation curable medium may comprise one type of radiation curable compound or alternatively, the radiation curable medium may comprise a mixture of radiation curable compounds.

The radiation curable medium may further comprise at least one inhibitor. An inhibitor is a component that prevent (inhibits) unwanted polymerization of the radiation curable compound. Inhibitors may be added to the radiation curable inkjet ink composition to increase the shelf life on the ink composition.

The radiation curable medium may further comprise at least one photo initiator. A photo initiator is a component that improves the efficiency of curing; i.e. increases the

polymerization rate when the ink composition is irradiated with suitable radiation, such as UV radiation.

The radiation curable medium may further comprise a solvent, such as water or an organic solvent. The solvent may be added to the radiation curable medium to tune ink properties, such as viscosity.

Further, additional components may be added to the radiation curable medium. For example, the radiation curable medium may comprise surfactants, antibacterial components and anti-fungi components.

Colorant

The radiation curable inkjet ink composition may further a colorant, such as a pigment, a dye or a mixture thereof. Further, the radiation curable inkjet ink composition may comprise a mixture of dyes and/or a mixture of pigments. The colorant may provide the ink composition with a predetermined color.

Ester compound

The radiation curable inkjet ink composition may further comprise an ester compound. According to the present disclosure, the ester compound consists essentially of a condensation product of a first reactant and a second reactant, wherein the first reactant is a compound A comprising at least 3 first functional groups, and wherein the second reactant comprises at least one compound B, wherein the at least one compound B comprises a second functional group, wherein the first functional group is a first group selected from a hydroxyl functional group and a carboxylic acid functional group and the second functional group is a second group selected from a hydroxyl functional group and a carboxylic acid functional group, wherein the first functional group is different from the second functional group.

Hence, the ester compound may consist essentially of a condensation product of a first reactant and a second reactant, wherein the first reactant is a compound A comprising at least 3 hydroxyl functional group functional groups and wherein the second reactant comprises at least one compound B, wherein the at least one compound B comprises a carboxylic functional group. Alternatively, the ester compound may consist essentially of a condensation product of a first reactant and a second reactant, wherein the first reactant is a compound A comprising at least 3 carboxylic acid functional groups and wherein the second reactant comprises at least one compound B, wherein the at least one compound B comprises a hydroxyl functional group.

Preferably, compound B comprises only one second group. In case the second group is a hydroxyl functional group, the compound B preferably comprises only one hydroxyl functional group. In case the second group is a carboxylic acid group, the compound B preferably comprises only one carboxylic acid group.

The ester compound formed by reacting the first reactant and the second reactant may be a nonlinear ester compound. The ester compound may comprise at least three ester groups. The ester compound may provide the radiation curable inkjet ink composition with gelling properties.

The ester compound may be used as a gelling agent in a radiation-curable inkjet ink composition for obtaining a glossy image.

An ink composition comprising an ester compound in accordance with the present disclosuremay be capable of providing high gloss images. The ester compound may form a 3-dimensional network in the ink composition upon cooling down, thereby changing the rheological properties of the ink composition. Hence, when the droplets of ink cool down after being jetted onto a recording medium, the viscosity of the ink may increase and excessive flow of the ink droplets may be prevented, thereby preventing colorbleed.

The ester compound may be present in an amount of 0.3 wt% - 3.0 wt% based on the total weight of the radiation-curable inkjet ink composition. Preferably, the ester compound may be present in an amount of 0.5 wt% - 2.5 wt% based on the total weight of the radiation-curable inkjet ink composition, more preferably from 0.8 wt% - 2.2 wt%, for example from 1.0 wt% – 2.0 wt%.

In case the ink composition comprises less than 0.3 wt% of the ester compound based on the total weight of the radiation-curable inkjet ink composition, then the increase in viscosity of the ink after printing on the recording medium may be insufficient to prevent color bleeding. Hence, too little ester compound may result in decreased print quality. In case the ink composition comprises more than 3.0 wt% of the ester component, then the gloss level of the printed image may decrease.

In an embodiment, the ester compound does not comprise a (meth)acrylate functional group and/or a vinyl functional group. The ester compound therefore may not undergo a polymerization reaction upon irradiating the ink composition with actinic energy radiation, such as UV radiation.

In an embodiment, gloss of an image may be determined using a micro-TRI gloss meter

obtained from BYK-Gardner GmbH using the internal calibration and measurement method. In case the gloss level measured under an angle of 60° is at least 35, preferably at least 40, the image may be considered to be a high gloss image.
In case the gloss level measured under an angle of 60°is less than 35, the image may be considered a low gloss image (matt).

In an embodiment, the compound A is selected from the group consisting of pentaerythritol, cyclodextrine, glycerol, dipentaerythritol, 2-(hydroxymethyl)-2-methylpropane-1,3-diol, 2-ethyl-2-(hydroxymethyl)propane-1,3-diol, 2-(hydroxymethyl)propane-1,3-diol, trimethylolethane, trimethylolpropane, trimethylolbutane and trimethylolpentane.
These compounds are compounds comprising at least 3 hydroxyl functional groups. When reacted with a carboxylic acid, ester compounds can be formed.
Esters obtainable by reacting a carboxylic ester with a compound A selected from the above listed group may be esters having a branched structure (i.e. non-linear esters). Without wanting to be bound to any theory, it is believed that a branched structure may decrease the tendency of the ester compound to crystallize when cooling down. Hence, ester compound obtainable from the above mentioned polyalcohol components may not crystallize when cooling down. This may improve the gloss of a print made with an ink composition comprising such ester compound.
Methods for synthesizing ester compounds starting from a compound comprising a plurality of hydroxyl functional groups and a compound comprising a carboxylic acid group are known in the art.

In an embodiment, the compound B is a compound according to formula I, wherein R is an alkyl group, an aryl group or an alkylarylgroup, wherein R is a group having 5-30 carbon atoms.

formula I : R-C(O)OH

Compounds according to formula I are suitable to form ester compounds in accordance with the present disclosure. The properties of the ester compound may be influenced by the choice of the functional group R. The nature of the R group may for example influence the melting point of the ester compound and the rate of diffusion of the ester compound in the inkjet ink composition. R may be an alkyl group, an aryl group or an

In an embodiment, the radiation curable component is an acrylate having two or more acrylate functional groups. An acrylate may undergo a polymerization reaction when irradiated by suitable radiation, such as UV radiation. Hence, a polyacrylate polymer may be formed when an inkjet ink composition comprising an acrylate is cured, thereby hardening the ink. An acrylate molecule having two or more acrylate functional groups may react with two or more other acrylate molecules and hence, a polymeric network may be formed. Examples of acrylates having two or more acrylate functional groups are known in the art.

In a further embodiment, the ink composition further comprises a monofunctional acrylate. Presence of a monofunctional acrylate may improve the hardness and flexibility of the ink layer after curing.

In an embodiment, the ester compound is a gelling agent. The ester compound may be used as a gelling agent in a radiation-curable inkjet ink composition for obtaining a glossy image.
An ink composition comprising an ester compound in accordance with the present disclosuremay be capable of providing high gloss images. The ester compound may form a 3-dimensional network in the ink composition upon cooling down, thereby changing the rheological properties of the ink composition. Hence, when the droplets of ink cool down after being jetted onto a recording medium, the viscosity of the ink may increase and excessive flow of the ink droplets may be prevented, thereby preventing colorbleed.

The present disclosure provides a method for preparing a radiation-curable inkjet ink composition is provided, the method comprising the steps of:

- providing a radiation-curable component;
- providing an ester compound in accordance with the present disclosure; and
- mixing the radiation-curable component and the ester compound.

In one aspect of the present disclosure, there is provided a radiation-curable inkjet ink composition comprising a radiation curable component, the radiation-curable inkjet ink composition further comprising an ester compound, the ester compound consisting essentially of a condensation product of a first reactant and a second reactant, wherein

the first reactant is a compound A comprising at least 3 first functional groups, and wherein the second reactant comprises at least one compound B, wherein the at least one compound B comprises a second functional group, wherein the first functional group is a first group selected from a hydroxyl functional group and a carboxylic acid functional group and the second functional group is a second group selected from a hydroxyl functional group and a carboxylic acid functional group, wherein the first functional group is different from the second functional group and wherein the ester compound is present in an amount of 0.3 wt% - 3.0 wt% based on the total weight of the radiation-curable inkjet ink composition .

The radiation-curable component and the ester compound may be provided. Optionally, additional components may be provided, for example an additional solvent. The radiation-curable component and the ester compound may be provided neat or they may be provided in a solution or dispersion. Optionally, a colorant may be provided. In case the colorant is a pigment, the pigment is preferably provided as a dispersion, such

as an aqueous pigment dispersion. The components may be provided at once, or the components may be added subsequently. The components may be added in any suitable order. In case a dispersible component is added (pigment and/or latex particles), such dispersible component may be preferably added after the other components of the ink composition are provided. Mixing of the components may be carried out at any suitable temperature, for example room temperature.

ITthe present disclosure also provides a method for applying an image onto a recording medium is provided, the method comprising the steps of:

a. jetting droplets of a radiation-curable inkjet ink composition according to the present disclosureonto the recording medium;

b. curing the radiation-curable inkjet ink composition by irradiating the ink composition using UV radiation.

In an aspect of the present disclosure, there is provided a method for preparing a radiation-curable inkjet ink composition according to the present disclosure, the method comprising the steps of:

- providing a radiation curable component;
- providing an ester compound, the ester compound consisting essentially of a condensation product of a first reactant and a second reactant, wherein the first reactant is a compound A comprising at least 3 first functional groups, and wherein the second reactant comprises at least one compound B, wherein the at least one compound B comprises a second functional group, wherein the first functional group is a first group selected from a hydroxyl functional group and a carboxylic acid functional group and the second functional group is a second group selected from a hydroxyl functional group and a carboxylic acid functional group, wherein the first functional group is different from the second functional group; and
- mixing the radiation curable component and the ester compound.

In another aspect of the present disclosure, there is provided a method for applying an image onto a recording medium, the method comprising the steps of :

a. jetting droplets of a radiation-curable inkjet ink composition according to claim 1 onto the recording medium;
b. curing the radiation-curable inkjet ink composition by irradiating the ink composition using UV radiation.

In the method, an image is applied onto a recording medium. In the method, in step a), an image is applied to the recording medium. The image may be applied using an ink composition according to the present disclosure. The ink composition may be applied onto the recording medium in a predetermined fashion, e.g. in accordance with image files stored on suitable storing means. The image may be applied for example by jetting droplets of the radiation-curable inkjet ink composition using an inkjet print head. The recording medium may be a sheet-like medium, such as a sheet of paper or a sheet of vinyl. Alternatively, the recording medium may be a web, for example an endless belt. The web may be made of a suitable material. Optionally, the image may be dried after it has been applied onto the intermediate transfer member.
In the method, in step b), the radiation-curable inkjet ink composition is cured by irradiating the ink composition using UV radiation. The inkjet ink composition may be irradiated using a suitable source of radiation, such as a halogen lamp, a mercury lamp and/or a LED lamp. Optionally, a plurality of sources of radiation may be used to irradiate the inkjet ink composition.

In a further aspect of the present disclosure, there is provided a use of an ester compound in a radiation-curable inkjet ink composition for obtaining a glossy image, wherein the ester compound consists essentially of a condensation product of a first reactant and a second reactant, wherein the first reactant is a compound A comprising at least 3 first functional groups, and wherein the second reactant comprises at least one compound B, wherein the at least one compound B comprises a second functional group, wherein the first functional group is a first group selected from a hydroxyl functional group and a carboxylic acid functional group and the second functional group is a second group selected from a hydroxyl functional group and a carboxylic acid functional group, wherein the first functional group is different from the second functional group.

In another aspect of the present disclosure, there is provided a use of pentaerythritoltetrastearate in a radiation-curable inkjet ink composition for obtaining a glossy image.

Brief description of the drawings

These and further features and advantages of the present invention are explained hereinafter with reference to the accompanying drawings showing non-limiting embodiments and wherein: