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PROCESS FOR THE PREPARATION OF PRESSURE-SENSITIVE COPYING PAPERS

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6 Claims

ABSTRACT OF THE DISCLOSURE

In the preparation of a pressure-sensitive transfer paper by a procedure which involves hardening microcapsules, containing a colorless electron-donor organic compound, by the addition of formaldehyde, and then applying a dispersion of the capsules to a substrate, the trouble caused by the generation of an irritating odor of formaldehyde vapor is prevented by adding sodium sulfite or urea to the dispersion.

BACKGROUND OF THE INVENTION**Field of the invention**

The present invention relates to a process for the preparation of pressure-sensitive copying papers and more particularly to a process for the preparation of a transfer paper or capsule paper unaccompanied by the troubles caused by the generation of an irritating odor.

When a colorless electron-donor organic compound is adsorbed on an electron-acceptor adsorbent, an electron donor-acceptor adsorption chemical reaction occurs to form a colored material from the two colorless starting materials. Some pressure-sensitive copying papers utilize this principle. That is, a common pressure-sensitive capsule paper has on its surface a thin layer having dispersed therein microencapsulated, non-volatile, fine liquid particles or droplets containing a colorless electron-donor compound. The microcapsules are capable of being ruptured by local pressure, such as by hand-writing with a pencil, a stylus or a ballpoint pen or by typewriting. The paper is placed on an absorbent paper having thereon a layer consisting of an adsorbent and a binder so that the capsule layer is brought into contact with the adsorbent layer. Thereafter the assembly is locally pressed by hand-writing or typewriting to form color only in the region of the pressed portions.

Discussion of the prior art

Hitherto, the electron-donor, organic compound to be used for the pressure-sensitive capsule paper is contained in microcapsules made of gelatin or gum arabic. To endow the capsules with water resistance and hardness, formaldehyde is usually added to the coating composition of the capsule dispersion. The formaldehyde is caused to react with the film-forming material which comprises the walls of the capsules, such as, gelatin. But, in the production of the pressure-sensitive copying papers, free formaldehyde, unreacted with gelatin, is coated on the base papers together with the capsules. Hence, the formaldehyde is evaporated at the coating step or subsequent working steps to generate a specific irritating odor. This irritating odor has a very harmful influence on the health of workers in the manufacturing factory and hence is undesirable in terms of physiology and hygienics.

Thus, the inventors have studied ways for preventing the evaporation of formaldehyde during the manufacturing process of pressure-sensitive copying papers and for removing the irritating odor, and have found a process

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for fixing the free formaldehyde by reacting it with a material reactive with the formaldehyde.

Therefore, an object of this invention is to provide a process for preventing the generation of the irritating odor of formaldehyde in the production of pressure-sensitive copying papers.

Another object of this invention is to provide a process for producing pressure-sensitive papers without generating the irritating odor of formaldehyde.

Still another object of this invention is to provide pressure-sensitive capsule papers having no irritating odor of formaldehyde.

SUMMARY OF THE INVENTION

The objects of this invention can be attained according to the process of this invention, in the production of pressure-sensitive capsule papers which use formaldehyde to improve the water resistance and hardness of the microcapsules, by adding to the coating composition composed of the capsule, dispersion containing remaining free formaldehyde, sodium sulfite or urea to fix formaldehyde by reaction therewith.

When sodium sulfite or urea is added to the capsule dispersion, after the capsules are hardened by the addition of formaldehyde, the remaining free formaldehyde, which has not been reacted during the hardening treatment for the capsules, is caused to react with the sodium sulfite or urea to form immediately a crystalline addition product, whereby the formaldehyde is fixed. Thus, the generation of irritating odors caused by the evaporation of the free formaldehyde is completely prevented. In order to react sodium sulfite or urea with formaldehyde in the capsule dispersion, the temperature and contact period of time must be properly adjusted.

In the case of employing sodium sulfite the remaining formaldehyde may be sufficiently reacted with sodium sulfite under the conditions of a pH of from about 6 to 8, room temperature, and a reaction period of 2 hours. Sodium sulfite is a reducing agent. Hence, if materials which can be easily reduced are present in the system, the amount of sodium sulfite must be increased corresponding to the amount of such reducible materials.

In the case of urea, the reaction is possible in an acid state, i.e., a pH in the range of from about 3 to 5 and also in an alkaline state, i.e., a pH in the range of from about 8 to 12. The temperature may be 30–60° C. and the reaction time is about 4 hours.

The addition amount of sodium sulfite is suitably in an amount of from 1 to 1.5 mols per one mol of remaining formaldehyde and that of urea is from 1 to 3 mols per one mol of remaining formaldehyde. The addition of sodium sulfite or urea may preferably be made in a step at the end of the encapsulation and prior to storing the capsule dispersion in a tank, after which it is reacted with the remaining formaldehyde by adjusting the pH, temperature and the reaction period.

DESCRIPTION OF PREFERRED EMBODIMENTS

The invention will now be explained in detail by referring to the following examples.

EXAMPLE 1

A proper amount of an aqueous 10% sodium hydroxide solution was added into 100 kg. of a capsule dispersion for copying papers containing unreacted formaldehyde to adjust the pH thereof to 8–9. Into the dispersion was added 2 mols of urea per one mol of the remaining formaldehyde, followed by stirring to dissolve the urea therein. Thereafter, the capsule dispersion was stirred for 4 hours at a temperature of 50° C. When the thus prepared capsule dispersion was applied to paper, the

irritating odor caused by the presence of the remaining formaldehyde is reduced in the coating step and subsequent working steps. The properties of the pressure-sensitive copying paper were also good.

EXAMPLE 2

The capsule dispersion prepared by the same procedure as in Example 1 was applied to the opposite surface of an adsorbent paper to provide an intermediate paper and the irritating odor in the coating step and working steps was reduced as in the case of Example 1. The properties of the intermediate paper were also good.

EXAMPLE 3

Into 100 kg. of a capsule dispersion containing unreacted formaldehyde there was added a proper amount of 10% acetic acid to adjust the pH thereof to from 3 to 5. Into the dispersion was added 2 mols of urea per one mol of the remaining formaldehyde and the system was stirred to dissolve the urea. Then, the capsule dispersion was stirred for 4 hours at 35° C. When the thus prepared capsule dispersion was applied to paper, the irritating odor caused by the presence of the formaldehyde in the coating step and working steps was reduced and the properties of the thus obtained pressure-sensitive copying paper were good.

EXAMPLE 4

The capsule dispersion prepared by the same procedure as in Example 3 was applied to the opposite surface of a pressure-sensitive adsorbent paper to provide an intermediate paper and the irritating odor in the coating step and working steps was reduced as in Example 3.

EXAMPLE 5

The pH of 100 kg. of a capsule dispersion was adjusted to from 6 to 8 and 1.5 mols of sodium sulfite was added therein per one mol of the remaining formaldehyde followed by stirring for 2 hours at room temperature. In this case, the reaction of formaldehyde and sodium sulfite formed sodium hydroxide, which increased the pH of the dispersion. Hence, it was necessary to reduce the pH to less than 10 by adding 10% acetic acid. When the thus prepared capsule dispersion was applied to paper, the irritating odor in the coating step and working steps was reduced and the properties of the thus obtained pressure-sensitive copying paper were good.

EXAMPLE 6

The capsule dispersion prepared by the same procedure as in Example 5 was applied to the opposite surface of an

adsorbent paper to provide an intermediate paper. The irritating odor in the coating step and working steps was reduced and the properties of the intermediate paper were good.

What is claimed is:

1. A process for the production of pressure-sensitive copying papers which comprises adding formaldehyde to a dispersion of microcapsules to harden said microcapsules, droplets of said microcapsules comprising a fine colorless electron-donor organic compound encapsulated by a preparation of film-forming material and being useful for the pressure-sensitive copying papers, then adding to the dispersion a compound selected from the group consisting of sodium sulfite and urea, reacting said compound with remaining free formaldehyde which had not been used up in said hardening step, and then applying the resulting dispersion to a substrate.

2. The process as claimed in claim 1 wherein said additive is sodium sulfite and the amount of sodium sulfite added into the coating composition is from about 1 to 1.5 mols per one mol of said remaining formaldehyde.

3. The process as claimed in claim 2 wherein said sodium sulfite is added under the conditions of a pH of from 6 to 8 and at about normal ambient temperature.

4. The process as claimed in claim 1 wherein said additive is urea and the amount of urea added into the dispersion-containing coating liquid is from about 1 to 3 mols per one mol of remaining formaldehyde.

5. The process as claimed in claim 4 wherein said urea is added under the conditions of a pH of from about 3 to 5 and a temperature of from about 30° to 60° C.

6. The process as claimed in claim 4 wherein said urea is added under the conditions of a pH of from about 8 to 12 and a temperature of from about 30° to 60° C.

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