New Heat Sensitive Recording Composition Containing Phenolisatine Polymers

Y. S. Kim[1], C. Y. Kim[1], and E. K. Kim[2]
Department of Chem., Dongguk Univ. Seoul, South Korea[1]
Adv. Materials Div., Korea Research Inst. of Chemical Technology, Daejeon, South Korea[2]

Abstract

Phenolisatine polymers having high thermal stability were synthesized by condensation polymerization method and applied to a new thermosensitive recording media.

Recording composition was prepared by mixing the polymer with a leuco dye and a coupler. The resultant recording composition showed excellent hue and provided sufficient density of formed color up to 250°C as compared to the recording composition without phenolisatine polymers. Thermally erasable recording composition was prepared by adding a decolorant into above recording media containing phenolisatine polymers. The resultant recording media showed no loss of color up 170°C but visibly bleached at above 200°C, indicating potential use of the composition as a thermosensitive recording media. Effect of the composition of the recording media on the thermosensitivity will be presented.

Introduction

To prevent pollution of environment and save resources, the recycling of paper that is used in the office or organization of government has been required.

There are several method to prepare the recycling paper. In this study, we focused in the preparing erasable toner that contains leuco dye color-decolorizing system.

General components of toner are divided following four parts. Dye, CCA, wax and polymer. Commercially carbon has used as a dye. But we substituted leuco dye, colorizer and decolorizer for the carbon.

Color-decolorizing system, known until now, is like bellow. When the dye react with colorizer, lactone ring of leuco dye is open and its conjugation changes toward red shift, visible area.

In this study we propose new type of decolorizer that has many functional group in their polymer structure.

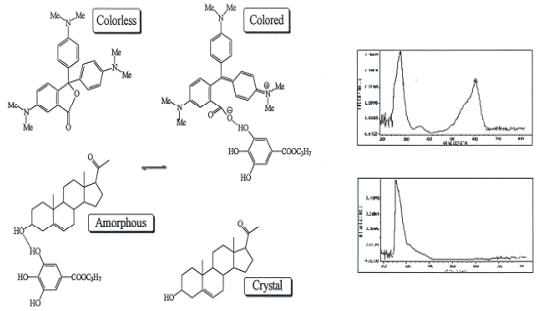
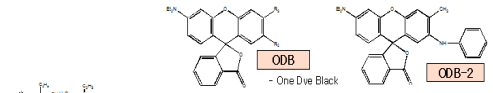
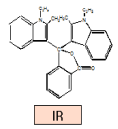


Figure 1. Decolorizing mechanism of leuco dye (CVL)

Experiment

Dye





No.	R2	R3	Color	No.	R2	R3	Color
1	-H	-Cl	black	7		-Me	black
2	-Cl	-Me	red-green	8		-Cl	black
3	Me	II	red	9		II	black
4	$-SO_2Me$	-H	red	10		-H	black
5	-NHAc	-H	red	11		-H	black
6		-H	green	12		-Me	red

Figure 2. Structures of leuco dye (ODB)

ODB-2 (One Dye Black) is the most frequently used leuco dye that has black color. It has so many derivatives changing functional group of its basic structure.

Colorizer (Developer)

Many of colorizer have –OH functional groups that react on ether group in lactone ring of dye. Because of this reaction, dye can shows colors.

Colorizers are also many, but here we used only BPA (bisphenol A) like below.

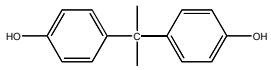


Figure 3. A structure of BPA

Decolorizer

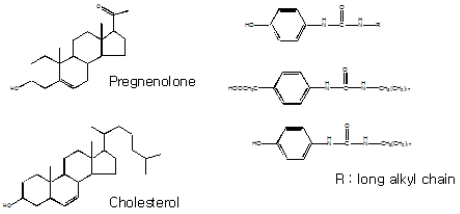


Figure 4. Structures of decolorizers

Pregnenolone, cholesterol and long alkyl chain phenylamine derivatives have been used in erasable toner consisting. But these materials have not good hue as well as commercial adaptation.

We proposed the polymer decolorizers that have many functional groups and good ability to decolorizing effect.

PVP (poly vinyl pyrrolidone) is a best decolorizer among these compounds.

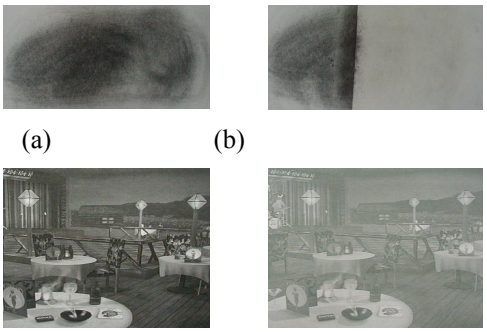


Figure 5. A decolorizing effect of PVP

Despite of its nice effect, PVP has a acute defection that it is very weak against high temperature resistance. Toner that commercially used must endure 120°C ~ 180°C because the plant system include high temperature process. But PVP's melting point is just below 120°C.

To avoid this defect, we suggested new polymers that have very similar functional groups those of PVP and high thermal resistance.

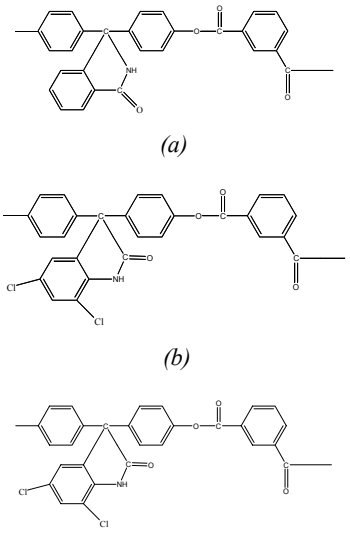


Figure 6. New decolorizer(phenolisatine polymers)

The synthesis method of phenolyisatine polymer is like below.

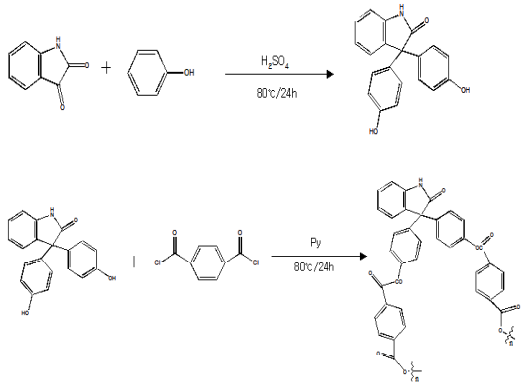


Figure 7.The synthesis of phenolisatine polymers

Result

Phenolisatine polymers had expected very good decolorizer that have thermal resistance. Actually those mingle with other component on high temperature. But there is no decolorizing effect. Moreover those effect reversed result that improves good hue. It is expected that phenolisatine polymer's molecular is 2200~2800m.w. so many of –OH groups still remain in there. Therefore those still react on lactone ring of dye.

But we tested decolorizing effect using these polymers by adduct and knew we can control the decolorizing temperature.

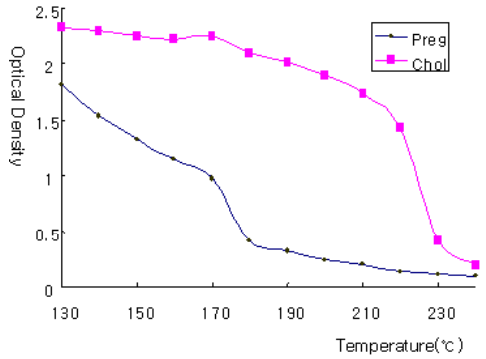


Figure 8. A decolorizing effect using phenolisatine polymer

In this test, we use PVP by decolorizer and pregnenolone,cholesterol by mix agent and phenolyisatine polymer to get improved good hue.

To control the decolorizing temperature, we changed a quantity of each component and derived below result.

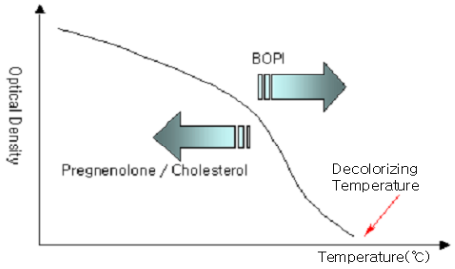


Figure 9. Effect trough the changing component

If BOPI(phenolisatine polymer) is increased, then decolorizing temperature moves to high temperature and preg., cholesterol are increased, then decolorizing temperature moves to low temperature.

Conclusion

Pheolisatine polymers are expected very adaptable material to use decolorizer by ingredient of toner component. But it is very hard to synthesis polymer that has a high molecular weight. So we still make an effort to synthesis of that polymer.

Instead of such an effort, we studied about changing ratio of each component, colorizer, decolorizer, and adduct, and knew that controlling of decolorizig temperature is possible somehow.

References

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Biographies

Young Soon Kim is a professor of depart of chemistry at Dongguk University. She received her B.S and M.S degree in chemistry from Dongguk University. She received her Doctor of Engineering degree in department of electro-photo-optics from Tokai University. (email: yskim@dgu.edu)

Chan Young Kim receved B.S degree in chemistry from Donguk University and now he is attending M.S course in chemistry at Dongguk University from 2002.

Eunkyoung Kim received her B.S degree in Chemistry from Yonsei University at Seoul (Korea) in 1982, a master degree in Chemistry from Seoul National University at Seoul (Korea) in 1984, and Ph.D. in Chemistry from University of Houston in 1990. Since 1992 she has been working in Korea Research Institute of Chemical Technology at Taejon, Korea. Her work has primarily focused on the development of functional polymers, including photopolymers, photochromic polymers, photoconductive polymers, and charge transport issues. She is a committee member of Korean Society for Imaging Science and Technology.(email:ekkim@krict.re.kr)