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PROCESS AND COMPOSITION FOR DEINKING WASTE PAPER
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- (57) Claim

1. A process for the deinking of wastepaper stocks containing electrostatic printed ink, impact printed ink, or combinations thereof, which comprises the following steps:

(a) converting the wastepaper to a pulp;

(b) contacting the pulp with an aqueous medium containing a treatment comprising an alcohol randomly alkoxyated with a mixture of alkylene oxides to form a surfactant, and a thiol ethoxylate surfactant with a degree of ethoxylation of up to 3 moles of ethylene oxide, the treatment enhancing the aggregation and densification of electrostatic toner particles, while promoting foaming in the aqueous medium; and

(c) mechanically processing the resulting pulp-containing medium to remove treated ink therefrom.



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(21) International Application Number: PCT/US96/05576 (22) International Filing Date: 19 April 1996 (19.04.96) (30) Priority Data: 08/432,738 2 May 1995 (02.05.95) US <i>BETZ DEARBORN INC.</i> (71) Applicant: BETZ LABORATORIES, INC. [US/US]; 4636 Somerton Road, Trevoise, PA 19053-6783 (US). (72) Inventor: SUTMAN, Frank, J.; 9748 Chesterfield Drive, Jacksonville, FL 32257 (US). (74) Agents: PAIKOFF, Richard, A. et al.; Betz Laboratories, Inc., 4636 Somerton Road, Trevoise, PA 19053-6783 (US).		(81) Designated States: AU, CA, JP, KR, NO, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published With international search report. 
(54) Title: PROCESS AND COMPOSITION FOR DEINKING WASTE PAPER (57) Abstract A process and composition for deinking waste paper is disclosed. The process comprises administering an alcohol, randomly alkoxylated with a mixture of alkylene oxides to form a surfactant, to a sample of waste paper for which treatment is desired. The surfactant enhances the aggregation and densification of electrostatic toner particles, while promoting foaming in the aqueous slurry.		

PROCESS AND COMPOSITION FOR DEINKING WASTE PAPER

TECHNICAL FIELD

The present invention deals with a process and composition for deinking waste paper. The treatment enhances the aggregation and densification of electrostatic toner particles, while promoting foaming in the aqueous slurry.

5

BACKGROUND OF THE ART

Dry toner electrostatic printing inks, including laser and xerographic inks, are important and growing contaminants in the area of waste-
10 paper recycling. Traditionally, paper has been printed with water or oil-based inks which were adequately removed by conventional deinking procedures. In these methods, secondary fiber is mechanically pulped and contacted with an aqueous medium containing a surfactant. Ink is
15 separated from pulp fibers as a result of mechanical pulping and the action of the surfactant. The dispersed ink is separated from pulp fibers by such means as washing or flotation.

Conventional deinking processes have shown minimal success in dealing with dry toner electrostatic printing inks, with the necessary chemical and mechanical treatments of the furnish proving to be time consuming and often rendering a furnish which is unacceptable for many applications. The development of a deinking program for office waste contaminated with electrostatic printed copy will make this furnish more amenable to the recycling process.

The ability to recycle office waste will prove commercially advantageous and will have a significant impact on the conservation of virgin fiber resources. Although electrostatic printed waste has not reached the volume of impact printed waste commonly seen in the industry, indications are such that usage of electrostatic print is increasing steadily and that waste copies available to the recycling industry will also increase.

Some deinking systems employ chemical aggregation/densification followed by forward cleaning to remove non-impact inks, and flotation deinking to remove impact inks (i.e., offset) and other contaminants. The chemical nature of many of these deinking products has caused them to act as defoamers in aqueous papermaking systems. A separate flotation aid is thus often added to the flotation cell in order to overcome the defoaming effect of the earlier chemicals.

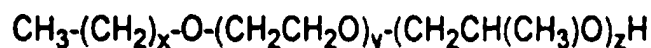
Furthermore, many aggregation/densification systems use relatively high application dosages in order to provide effective treatment. Existing office waste deinking technology utilizes product dosages of 0.60% - 0.75% on fiber to aggregate and densify the toner particles.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 illustrates a standard deinking sequence.

5 DISCLOSURE OF THE INVENTION

The present invention provides a process for the deinking of waste-
paper containing electrostatic printed ink, impact printed ink, or combina-
tions thereof, which comprises adding to an aqueous slurry of the waste-
10 paper a compound which enhances the aggregation and densification of
electrostatic toner particles, while promoting foaming in said aqueous
slurry. A preferred class of compounds are the random alcohol alkoxy-
lates, with a random linear alcohol alkoxylate surfactant being particularly
preferred, although branched forms of these compounds are also antici-
15 pated to be effective. This substance has the following structure:



$$11 \leq x \leq 14$$

20

molecular weight $\cong$ 800 particularly preferred.

The process of the present invention includes the following steps:
wastepaper stocks containing electrostatic printed ink, impact printed ink,
25 or combinations thereof are converted to a pulp. The pulp is then con-
tacted with an aqueous medium containing a treatment comprising a ran-
dom alcohol alkoxylate surfactant, e.g., with ethylene oxide and propyl-
ene oxide groups, and a thiol ethoxylate surfactant, the latter preferably

with a degree of ethoxylation of up to 3 moles of ethylene oxide. The resulting pulp-containing medium is then mechanically processed to remove treated ink therefrom.

- 5 The molecular weight range of the random linear alcohol alkoxy-
late surfactant is preferably from 600-1000; the temperature of treatment
may be from 130°F-180°F, with a pH of from 5.0 to 12.0 preferred.
Furthermore, the random alcohol alkoxyate surfactant possesses an
aqueous cloud point of 15-25°C.

10

By random alcohol alkoxyate, it is meant an alcohol randomly
alkoxylated with a mixture of alkylene oxides (e.g., ethylene oxide and
propylene oxide) as described below.

- 15 Conventional blocked alkoxyates have all of the oxyethylene
monomers congruent to each other on the chain. All of the oxypropylene
monomers follow, forming a cap. Molecules of this type which are effec-
tive for office waste deinking are typically water-insoluble, and act as de-
foamers. Random alkoxyates react ethylene oxide and propylene oxide
20 at the same time with the alcohol hydrophobe. A randomized distribution
of the oxyethylene and oxypropylene monomers is therefore obtained.
These compounds have been found to be efficient agents to aggregate
and densify non-impact inks while remaining water soluble.

- 25 An important improvement over previous treatment approaches is
the foaming potential of the formulations which allows for the complete
elimination of a separate flotation deinking agent. The result is that an
effective aggregation/densification agent for electrostatic printing inks
may also act as a flotation aid.

In addition, enhanced treatment efficiencies are obtained at lower product dosages as compared to previous treatments. The stock is deinked at a product dosage of 0.30 weight % on fiber, as compared to 0.60-0.75% on fiber with previous treatments (weight percent is based on dry fiber in pulper).

Examples

Example 1

10 A dose of 0.30% on fiber of a formulation containing a random linear alcohol alkoxylate, a thiol ethoxylate and a secondary alcohol ethoxylate (the latter with an $HLB \leq 10$) were added to a pilot-scale hydropulper containing 200 pounds of sorted office waste and 200 gallons of water, which had been heated to 150°F and adjusted to a pH of 11 with sodium
15 hydroxide. The mixture was pulped for 45 minutes. After pulping, it was diluted and processed through a standard deinking sequence, shown in Figure 1.

Deinking system performance in removing the non-impact inks was
20 evaluated by dirt count. Results are found in Table I. These results were achieved at a 50% chemical dose basis as compared to existing office waste deinking chemistry added to the hydropulper. For comparison, results obtained with conventional office waste deinking chemistry are also found in Table I. Also, a further process simplification was realized, by
25 eliminating the 0.40% on fiber of flotation aid dosage, which typically is added prior to flotation in order to achieve sufficient frothing for impact ink removal. It is worthy to note that both processes removed over 99%

of the visible dirt due to the non-impact inks. However, the present invention did so at a substantially lower treatment dosage and without the use of an additional flotation aid.

- 5 The removal of dispersed impact inks with the present invention was evaluated by brightness measurement on pulp pads. Most dispersed inks will be removed by flotation and washing so long as the correct treatment is carried out. Flotation feed stock had a brightness of 55.0%; flotation deinking raised the brightness to 56.8%. The flotation froth rejects
10 had a brightness of 47.1%, indicating significant dispersed ink removal in the flotation cell without the addition of a separate flotation aid. Washing across a high speed belt washer raised the stock brightness to 63.8%.

TABLE I

		<u>Treatment</u>	
		<u>A</u>	<u>B</u>
15	<u>Pulper Chemistry</u>		
	Pulper Dosage (% on Fiber)	0.30	0.75
	Separate Flotation Aid (fatty acid ethoxylate)	No	Yes
	Flotation Dosage (% on Fiber)	0	0.40
	Pulper Dirt Count (ppm)	873	578
20	Deinked Dirt Count (ppm)	4	5
	Dirt Reduction - Pulper to Washer (%)	99.5%	99.1%
	Pulper Speck Count (no./sq.m.)	12,155	7,555
	Deinked Speck Count (no./sq.m.)	100	100
	Speck Reduction - Pulper to Washer (%)	99.2%	98.7%
25	A: Blend of (a) random linear alcohol alkoxylate, (b) thiol ethoxylate and (c) secondary alcohol ethoxylate in a ratio of (a):(b):(c) of 7:1:2. Thiol ethoxylate may have a hydrophile-lipophile balance (HLB) of from 2-6.		
30	B: Commercial deinking product - see U.S. Patent 5,141,598.		

Example 2

A number of different formulations were tested which contained varying concentrations of thiol ethoxylates and random alcohol alkoxy-
lates. These were dosed individually to 18 g benchtop hydropulpers con-
taining sorted office waste at dosages of 0.2% and 0.4%, on dry fiber.
This was compared to conventional treatments dosed at the same levels.
Pulpers were run for 45 minutes at 150°F, a pH of 11, and a 6%
consistency (concentration of fiber in pulper, i.e., 6 lbs. fiber/100 lbs. of
pulp slurry).

10

Results are contained in Table II. As shown, the formulations of
the present invention produced enhanced ink particle aggregation (a
lower percentage of small ink particles) and higher ink particle density
values than an equal dosage of conventional treatments.

15

TABLE II

	<u>Formulation</u>	<u>Dose % on Fiber</u>	<u>Aggregation % area $\leq$ 0.03 sq.mm.</u>	<u>Mean Density (g/cc)</u>
20	A	0.2	23.6	1.022
	B	0.2	14.4	1.035
	C	0.2	7.4	1.046
	D	0.2	10.1	1.048
	E	0.2	20.2	1.040
25	A	0.4	18.0	1.028
	B	0.4	10.7	1.132
	C	0.4	7.0	1.126
	D	0.4	8.5	1.060
	E	0.4	6.6	1.164

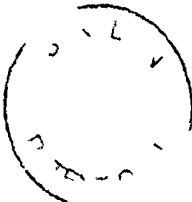
30 A: Commercial deinking product - see U.S. Patent 5,141,598.

B - E: Blends of (a) random linear alcohol alkoxylate,
(b) thiol ethoxylate and
(c) secondary alcohol ethoxylate, in ratio of (a):(b):(c) of

- B: 4:0:3, with remainder as triethylene glycol
5 C: 2:2:3, with remainder as triethylene glycol
D: 3:3:1, with remainder as triethylene glycol
E: 7:1.5:1.5

(thiol ethoxylate may have an HLB from 2-6; secondary alcohol
ethoxylate $HLB \leq 10$).

Throughout this specification and the claims, the words
"comprise", "comprises" and "comprising" are used in a non-
exclusive sense.



THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A process for the deinking of wastepaper stocks containing electrostatic printed ink, impact printed ink,
5 or combinations thereof, which comprises the following steps:
 - (a) converting the wastepaper to a pulp;
 - (b) contacting the pulp with an aqueous medium
10 containing a treatment comprising an alcohol randomly alkoxyated with a mixture of alkylene oxides to form a surfactant, and a thiol ethoxylate surfactant with a degree of ethoxylation of up to 3 moles of ethylene oxide, the treatment enhancing the aggregation and
15 densification of electrostatic toner particles, while promoting foaming in the aqueous medium; and
 - (c) mechanically processing the resulting pulp-containing medium to remove treated ink therefrom.
20
2. A process according to claim 1, wherein the surfactant contains ethylene oxide and propylene oxide subunits.
- 25 3. A process according to claim 2, wherein the surfactant has a molecular weight of from 600-1000.
4. A process according to claim 1, wherein the temperature is from 130°F - 180°F (54.4°C - 82.2°C).
30
5. A process according to claim 1, wherein the pH is from 5.0 to 12.0.
6. A process according to claim 1, wherein from
35 0.2 -0.4 weight percent of the treatment, based on dry fiber, is contacted with the pulp.

7. A composition for the deinking of wastepaper containing electrostatic printed ink, impact printed ink or combinations thereof, which comprises a combination of (a)
5 an alcohol randomly alkoxyated with a mixture of alkylene oxides to form a surfactant and (b) a thiol ethoxylate surfactant with a degree of ethoxylation of up to 3 moles of ethylene oxide.

10 8. A composition according to claim 7, wherein (a) has a molecular weight of from 600-1000.

9. A composition according to claim 7, further comprising a secondary alcohol alkoxyate with an HLB of up
15 to 10.

20 Dated this 4th day of November 1998

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