

be rinsed from the photoresist or solder mask with a compatible solvent or water. The effluents produced by these processes are impure solutions of propylene carbonate, gamma-butyrolactone and/or benzyl alcohol, laden with both dissolved and suspended photoresist or solder mask and other impurities. The commonly assigned U.S. Patent No. 5,275,734 of J.A. Shurtleff, and K.P. Unger for Chemical Pre-Treatment and Biological Destruction of Propylene Carbonate Waste Streams Effluent Streams to Reduce the Biological Oxygen Demand Thereof describes a method of treating a process waste stream containing the non-biodegradable solvent propylene carbonate. However, none of the references provide a method for treating the waste streams which result from developing or stripping photoresists and solder masks with gamma-butyrolactone and/or benzyl alcohol.

SUMMARY OF THE INVENTION

According to one aspect of the present invention there is disclosed a method of treating a waste stream from a photolithographic process producing a gamma-butyrolactone waste stream consisting essentially of the following steps: (a) collecting the waste stream at a pH of about 8 to 10; (b) acidifying the waste stream to a pH of about 7.5 to 8.5; and (c) aerating the acidified waste stream in an activated biomass capable of aerobically metabolizing the gamma-butyrolactone and thereby forming water and carbon dioxide and reducing the biological oxygen demand of the gamma-butyrolactone.

According to another aspect of the present invention there is disclosed a method of treating a waste stream from a photolithographic process producing a benzyl alcohol waste stream consisting essentially of the following steps: (a) collecting the waste stream at a pH of about 8 to 10; (b) acidifying the waste stream to a pH of about 7.5 to 8.5; and (c) aerating the acidified waste stream in an activated biomass capable of aerobically metabolizing the benzyl alcohol and thereby forming water and carbon dioxide and reducing the biological oxygen demand of the benzyl alcohol.

According to still another aspect of the present invention there is disclosed a method of treating a waste stream from a photolithographic process, wherein the waste stream contains photoresist and gamma butyrolactone and the method consists essentially of the following steps: (a) collecting the waste stream at a pH of about 8 to 10; (b) acidifying the waste stream to a pH of about 7.5 to 8.5; and (c) aerating the acidified waste stream in an activated biomass capable of aerobically metabolizing the gamma-butyrolactone and thereby forming water and carbon dioxide and reducing the biological oxygen demand of the waste stream.

According to still another aspect of the present invention there is disclosed a method of treating a waste stream from a photolithographic process, wherein the waste stream contains benzyl alcohol and photoresist and the method consists essentially of the following steps: (a) collecting the waste stream at a pH of about 8 to 10; (b) acidifying the waste stream to a pH of about 7.5 to 8.5; (c) aerating the acidified waste stream in an activated biomass capable of aerobically metabolizing the benzyl alcohol and thereby forming water and carbon dioxide and reducing the biological oxygen demand of the waste stream.

CLAIMS

- 1. A method of treating a waste stream from a photolithographic process producing a gamma-butyrolactone waste stream consisting essentially of the following steps:
 - (a) collecting the waste stream at a pH of about 8 to 10;
 - (b) acidifying the waste stream to a pH of about 7.5 to 8.5; and
 - (c) aerating the acidified waste stream in an activated biomass capable of aerobically metabolizing the gamma-butyrolactone and thereby forming water and carbon dioxide and reducing the biological oxygen demand of the gamma-butyrolactone.
2. The method of claim 1 comprising aerating the acidified waste stream for a time sufficient to reduce the biological oxygen demand by at least about 95 %.
3. A method of treating a waste stream from a photolithographic process producing a benzyl alcohol waste stream consisting essentially of the following steps:
 - (a) collecting the waste stream at a pH of about 8 to 10;
 - (b) acidifying the waste stream to a pH of about 7.5 to 8.5; and
 - (c) aerating the acidified waste stream in an activated biomass capable of aerobically metabolizing the benzyl alcohol and thereby forming water and carbon dioxide and reducing the biological oxygen demand of the benzyl alcohol.
4. The method of claim 1 comprising aerating the acidified waste stream for a time sufficient to reduce the biological oxygen demand by at least about 95 %.
5. A method of treating a waste stream from a photolithographic process, wherein the waste stream contains photoresist and gamma butyrolactone and the method consists essentially of the following steps:
 - (a) collecting the waste stream at a pH of about 8 to 10;
 - (b) acidifying the waste stream to a pH of about 7.5 to 8.5; and
 - (c) aerating the acidified waste stream in an activated biomass capable of aerobically metabolizing the gamma-butyrolactone and thereby forming water and carbon dioxide and reducing the biological oxygen demand of the waste stream.

6. The method of claim 5 wherein a waste stream having a biological oxygen demand of about 960 ppm is aerated at least about 48 hours.
7. The method of claim 5 further comprising the step of sparging air into the biomass to maintain the amount of dissolved oxygen in the biomass at 1.5 ppm to 2.5 ppm.
8. The method of claim 5 wherein the respiration rate of the biomass is maintained between about 100 to 60 ml O₂ /L of biomass/hr upon addition of the waste stream to about 15 ml O₂ /L biomass/hr at the end of the treatment.
9. A method of treating a waste stream from a photolithographic process, wherein the waste stream contains benzyl alcohol and photoresist and the method consists essentially of the following steps:
 - (a) collecting the waste stream at a pH of about 8 to 10;
 - (b) acidifying the waste stream to a pH of about 7.5 to 8.5;
 - (c) aerating the acidified waste stream in an activated biomass capable of aerobically metabolizing the benzyl alcohol and thereby forming water and carbon dioxide and reducing the biological oxygen demand of the waste stream.
10. The method of claim 9 wherein a waste stream having a biological oxygen demand of about 860 ppm is aerated at least about 48 hours.
11. The method claim 9 further comprising the step of sparging air into the biomass to maintain the amount of dissolved oxygen in the biomass at 1.5 ppm to 2.5 ppm.
12. The method of claim 9 wherein the respiration rate of the biomass is maintained between about 100 to 60 ml O₂ /L of biomass/hr upon addition of the waste stream to about 15 ml O₂ /L biomass/hr at the end of the treatment.

**METHOD FOR TREATING PHOTOLITHOGRAPHIC DEVELOPER AND
STRIPPER WASTE STREAMS CONTAINING RESIST OR SOLDER MASK AND
GAMMA BUTYROLACTONE OR BENZYL ALCOHOL**

ABSTRACT

A method is disclosed for using the simple, environmentally-friendly organic compounds gamma-butyrolactone and benzyl alcohol to develop and to strip free radical-initiated, addition polymerizable resists, cationically cured resists and solder masks and Vacrel photoresists. In all cases the developers and strippers include gamma butyrolactone or benzyl alcohol. The developers and strippers optionally also include a minor amount of methanol, ethanol, isopropyl alcohol, propylene glycol monomethylacetate, ethylene glycol monomethyl ether, formamide, nitromethane, propylene oxide, or methyl ethyl ketone, acetone and water. During development of the photopatterned resist or solder mask, the unpolymerized regions are dissolved in the disclosed developers.