MORE SUSTAINABLE BIODEGRADABLE FOAMED ZIPPER

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ABSTRACT

The present disclosure relates to zipper for a reclosable package, particularly a zipper which has been foamed with the use of bioresins or biodegradable additives to increase the degradability of the zipper. The combination of the process of foaming with the use of bioresins or biodegradable additives typically increases the rate of degradability of the zipper, particularly in biodegradable environments, such as landfills.
MORE SUSTAINABLE BIODEGRADABLE FOAMED ZIPPER


BACKGROUND OF THE DISCLOSURE

[0002] 1. Field of the Disclosure
[0003] The present disclosure relates to zipper for a reprocessable package, particularly a zipper which has been foamed with the use of bioreins or biodegradable additives to increase the degradability of the zipper.
[0004] 2. Description of the Prior Art
[0005] It is well known that there is an increasing amount of plastic waste in the world. It is further well known that this plastic waste in landfills or similar environments is very slow to biodegrade. Even though the films have a thickness of only a few thousandths of an inch, the typical plastic polyethylene bag degrades very slowly, with essentially no degradation in thicker laminates. The addition of a zipper with flanges makes this problem even more difficult to solve. While bioreins (i.e., resins using biomass organic materials instead of traditional petroleum feedstock) can be somewhat helpful in facilitating degradation, further improvements are sought, especially those which maintain the desired qualities of the plastic products. Therefore, the topics of sustainability, bioreins, light weighting and biodegrading additives have become more and more important.
[0006] The use of foaming is well known in the plastics industry. For example, foaming has been used in extruded polyethylene zippers as shown in U.S. Pat. No. 5,520,463 entitled “Foamed Zipper” to Tilman, in PET blow molded bottles/jars as shown in U.S. Pat. No. 8,124,203 entitled “Container Having a Foamed Wall” to Semersky and in formaldehyde-melamine-sodium bisulfite copolymer Basotect® used in cleaning products. The reasons vary greatly from simple light weighting to significant physical property modification. Physical properties, induced changes can involve rigidity changes like making the article more spongy or increased stiffness, surface changes like increased roughness, transparency changes that can even lead to increased pearl escent properties and controlled bubble degradation through abrasion with water washing away the particulates.

OBJECTS AND SUMMARY OF THE DISCLOSURE

[0007] It is therefore an object of the present disclosure to provide improvements in the biodegradability of plastic zippers and similar products, preferably without significantly adversely impacting the desirable physical characteristics of these products.
[0008] This and other objects are obtained by combining the process of foaming with the use of bioreins or biodegradable additives to increase the rate of degradability. A foamed structure will effectively multiply the surface area of the structure by many times, allowing the reaction to occur simultaneously at an increased number of sites, thereby speeding up the degradation process. Therefore, a lower density, microporous structure of polyactic acid or any of the many available bioreins will decompose faster once the article is placed under the appropriate conditions to degrade, such as a landfill. The effect of the increased surface area is expected to be the same for most, if not all, of the oxo-biodegradable chemistry additives or any additives that promote degradation. The degradation reaction occurs at a surface of the structure, because that is where the material is exposed to the light, moisture, heat and microbes that drive the degradation process. Additionally, the use of polymers in the form of a thin film, in combination with other aspects of the disclosure, will further increase rates of degradation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Further objects and advantages of the disclosure will become apparent from the following description and from the accompanying drawings, wherein:
[0010] FIG. 1 is a plan view of a typical reprocessable plastic package or bag, using a zipper of the present disclosure.
[0011] FIG. 2 is a cross-sectional view along plane 2-2 of FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012] Referring now to the drawings in detail wherein like numerals indicate like elements throughout the several views, one sees that FIG. 1 is a plan view of a typical reprocessable package 100 with front and rear co-extensive walls 102, 104 which are joined to each other by side seals 106, 108, and bottom seal 110 (which may be replaced by a fold if front and rear walls 102, 104 are implemented as a single sheet of polymeric material) whereby forming a mouth 112 which is made to be reprocessable by zipper 10.
[0013] A typical embodiment of zipper 10 is shown in cross section in FIG. 2. This illustrated embodiment is meant only to be representative, in that a broad range of zipper designs is considered to be compatible with the present disclosure. Zipper 10 is typically made of polymeric material. Zipper 10 includes first and second profiles 12, 14, wherein first profile 12 includes a male interlocking element 16 and a first flange 18 while second profile 14 includes a female interlocking element 20 and a second flange 22. First profile 12 is sealed to the front wall 102 while second profile 14 is sealed to the rear wall 104. In the closed or interlocked position, male interlocking element 16 is received and engaged with female interlocking element 20. In the open position, the male and female interlocking elements 16, 20 are free of engagement with each other. Additionally, many embodiments may include the optional slider 24 which, as is known in the prior art, when moved in an opening direction, separates the male and female interlocking elements 16, 20 from each other and, when moved in a closing direction, interlocks the male and female interlocking elements 16, 20.

[0014] Pursuant to the present embodiment, the polymeric material which forms the zipper 10, particularly the first and second profiles 12, 14, include bioreins (such as, but not limited to, polylactic acid) or biodegradable additives (such as, but not limited to, thermoplastic starch or cellulose material) and further, is foamed.

[0015] A wide range of bioreins or bioplastics sourced from plants may be used. For example, the following may be used—resins made from polylactic acid produced by NatureWorks Inc. or Cereplast, Inc.; from corn, tapioca, potatoes or algae starch produced by Cereplast, Inc. or Novamont S.p.A. or the Teknor Apex Co.; from plant derived sugars produced by Metabolix in their Mirel™ and Mvera™ brands; and in
general resins derived from Poly-3-hydroxybutyrate (PHB), Polyhydroxyalkanoates (PHA), Polyamide 11 (PA 11) and the like.

[0016] Likewise, a wide range of additives may be used, particularly, those that promote plastic degradation using either ultra-violet (UV) light or microbial enhancing materials or oxygen additives applies for example EcolPure® starch additive produced by Bio-Tec Environmental LLC; any type of "oxo" chemistry additives including TDPAB® additive produced by EPI Environmental Products Inc., d2w® produced by Symphony Environmental, Reverte® produced by Wells Plastics Ltd.; or any additive that promotes plastic degradation. The use of these additives at a 0.5-5% weight basis in plant based bioreins or in petroleum based resins can, depending on the environment (the amount of exposure to light, moisture, heat, microbes, etc.) increase the rate of plastic degradation.

[0017] Although degradation test methods and conditions vary greatly, one may reference standard test methods (EN13432, ASTM D6002, ASTM D5511, ASTM D5526, ASTM D6400, ASTM D6866, etc.) for the appropriate conditions for this disclosure.

[0018] This is expected to result in the following advantages:

[0019] Firstly, a light-weighting zipper that costs less is typically achieved. This is important today in the bioreins cost more or additives add to the cost and are cost prohibitive.

[0020] Secondly, the synergy created with a foamed microstructure in combination with a bio-active resin/additive package is expected to increase the rate of decomposition under virtually any condition.

[0021] Thirdly, the combination of light-weighting via the foaming and the synergy created by the increased area of foam microstructure to promote degradation in bioactive systems is typically even more effective.

[0022] Fourthly, many bioreins tend to be stiffer than the typical polyethylene resins used to make flexible packaging. Foaming of the biorein will typically allow the finished product to be more flexible and workable as well as to decompose faster.

[0023] Fifthly, this is expected to form, in a more robust manner, a more sustainable zippered bag structure, regardless of the bag configuration or machine design.

[0024] A non-limiting example of an embodiment of the disclosure follows. Zipper that is typically 12 mm. wide and 70 mm. tall as shown in FIG. 2 typically weighs 5.0 pounds per 1000 feet. The overall finished zipper dimensions are important and typically must be kept constant to allow further commercial flexible film conversion on automatic form/fill/seal or pouch making machines to produce flexible bags and pouches of various styles like pillow or standup. Upon foaming, after changing the extruding and downstream processing conditions to maintain the overall dimensions, the weight depending on the blowing agent chosen and percent level could be reduced down to 2.3 pounds. However, at the lowest levels the extruded tape lost too much strength and was not functional and did not meet the required zipper performance characteristics. In an active backyard, home compost pile test, zipper that weighed between 4.5 and 3.5 pounds was evaluated for degradability and was found to have degradation rates of at least 1.5-times and up to 3-times greater than the 5.0 pound control. This increase in degradation rate is significantly more than the expected 1.1-1.3 times rate based simply on mass reduction. Therefore, under constant overall sizing, the foaming of a degradable plastic composition (single resin or with an additive or mixture) gave an unexpected higher decomposition rate than the materials without foaming.

[0025] Thus the several aforementioned objects and advantages are most effectively attained. Although preferred embodiments of the invention have been disclosed and described in detail herein, it should be understood that this invention is in no sense limited thereby and its scope is to be determined by that of the appended claims.

What is claimed is:

1. A zipper for a reclosable package or bag, the zipper being comprised of components made from polymeric material, wherein the polymeric material is foamed and includes an additive chosen from the group consisting of bioreins and biodegradable additives.

2. The zipper of claim 1 wherein the additive is polyactic acid.

3. The zipper of claim 1 wherein the additive is an oxybiodegradable additive.

4. The zipper of claim 1 wherein the additive is thermoplastic starch.

5. The zipper of claim 1 wherein the additive is a plant-derived sugar.

6. The zipper of claim 1 wherein the additive is cellulosic material.

7. The zipper of claim 1 wherein the additive is a resin derived from a chemical chosen from the group consisting of poly-3-hydroxybutyrate, polyhydroxyalkanoates, and polyamide 11.

8. The zipper of claim 1 wherein the zipper includes a first profile and a second profile.

9. The zipper of claim 8 wherein the first profile includes a first interlocking element and the second profile includes a second interlocking element.

10. The zipper of claim 9 wherein the first interlocking element is a male element and the second interlocking element is a female element.

11. The zipper of claim 8 further including a slider for interlocking the first and second profiles when moved in a closing direction and for separating the first and second profiles when moved in an opening direction.

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