A material in the form of a sheet for enveloping a bale of agricultural material is coated with or contains a preservative in order to prevent spoilage of wrapped bales of agricultural material by aerobic organisms.
BALE ENVELOPING MATERIAL CONTAINING A PRESERVATIVE

FIELD OF THE INVENTION

[0001] The invention concerns an enveloping material for the enveloping of a bale of agricultural material.

BACKGROUND OF THE INVENTION

[0002] It is known practice in the state of the art to envelop bales of agricultural products such as grass (hay) and straw with an air-tight and water-tight foil. Such wrapped bales may contain silage, that is, products with more than 50% moisture. The foil generates an anaerobic environment in the bale in which certain organisms which would lead to spoilage of the silage, such as in particular, aerobic fungi and bacteria, cannot survive. In this way, the foil prevents an undesirable spoilage of the products.

[0003] It is known practice from WO 90/07284 A and WO 92/17071 A to mix urea (a preservative) with agricultural products with relatively high moisture, to bale these and finally to wrap these. A chemical reaction develops in the bale that should lead to an increased protein and amyloid content.

[0004] Furthermore, it may be desirable for the reduction of losses in the harvest to wrap hay of lower moisture content with foil. Here it should be noted that only completely dried hay with a moisture of approximately 12% is wrapped since it is otherwise spoiled by aerobic fungi, bacteria or thermophilic actinomycetin. Hay can be dried to such a low moisture content only with a high degree of loss. In wrapped bales a drying to these low levels of moisture is not possible even with foils that permit passage of water. With moisture levels between 12% and 35% the application of preservatives would be possible, however, not with moisture levels above 35%, since these materials are not sufficiently effective at such high levels of moisture. For example, in DE 32 32 746 A, a bale is described in which preservatives are added to the harvested crop depending on its measured moisture level.

[0005] With wrapped silage bales, it is seen as problematic that undesirable holes in the envelope can destroy the anaerobic environment which can result in spoilage of the agricultural material by the aforementioned organisms. The proportion of the material spoiled depends on the size of the hole, the density of the bale and the depth to which the wind can penetrate under the envelope. The proportion of the material spoiled can affect a small volume or the entire bale, if it is too loose or too dry.

[0006] The problem underlying the invention is seen in the need to prevent spoilage of wrapped bales of agricultural material by aerobic organisms or at least to reduce the spoilage.

SUMMARY OF THE INVENTION

[0007] According to the present invention, there is provided an improved bale wrapping material.

[0008] An object of the invention is to envelop bales with an enveloping material consisting of a carrier material to which a preservative has been applied. The preservative is contained, for example, in a layer applied to the carrier material and/or in the enveloping material, which is sufficiently porous. With porous enveloping material the pores may be closed initially but already contain the preservative. The stretching of the enveloping material during the wrapping process opens the pores and releases the preservative. The preservative may be volatile so that it penetrates into the volume of the bale after the bale is wrapped and combats the undesirable organisms there. It is present in increased concentration at the surface that is particularly endangered by the penetration of airborne oxygen. A coating can be applied to the outside of the enveloping material to prevent the escape of the preservative.

[0009] In this way the preservative prevents spoilage of the agricultural material in the case of silage (products with more than 50% moisture) in the bale, if air reaches the bale through undesirable holes or tears in the enveloping material. The anaerobic organisms that otherwise lead to spoilage of the products are killed by the preservative. The enveloping material according to the invention protects the agricultural material from airborne oxygen, retains the preservative in the interior of the envelope and prevents an undesirable spoilage of the agricultural material, in case that holes or tears occur in the enveloping material. With the use of the enveloping material according to the invention it is also conceivable that hay bales with material having a moisture content of more or less than 35% could be wrapped.

[0010] The invention makes it possible to omit the addition of preservatives into the agricultural material. Thereby a saving is generated by the omission of arrangement for the metering of the preservative and measurement arrangements for the determination of the quantity required at that time. It is also conceivable that preservatives be metered into the agricultural material for bales of silage as well as hay.

[0011] The preservatives are, in particular, those chemicals used in the state of the art as preservatives for agricultural products, such as propionic acid, lactic acid, acetic acid, formaldehyde, ammonia compounds, urea, certain bacteria and fermentation products.

[0012] The preservative is preferably applied to the inner side of the carrier material facing the bale. In addition, or as an alternative, it can also be located on the outside of the carrier material.

[0013] As a rule, the invention is applied to bale wrapping arrangements or balers in which bales of agricultural material are wrapped or enclosed in enclosure materials according to the invention. The preservative may already be located on the enclosure material, that is, rolls of the enclosure material are used to which the preservative has been applied. It is also conceivable that the preservative be applied to the enclosure material only during the enclosure of the bale which can be applied as a liquid by spray nozzles or by means of immersion in a bath.

[0014] These and other objects will become apparent from a reading of the ensuing description together with the appended drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. 1 shows a left side elevational view of a combined round baler and bale wrapping machine with which wrapping material, made according to the present invention, may be used.
[0016] FIG. 2 shows a cross section through the enveloping material.

[0017] FIG. 3 shows an enlarged section of another embodiment of the combined baler and bale wrapping machine.

**DESCRIPTION OF THE PREFERRED EMBODIMENT**

[0018] FIG. 1 shows an agricultural machine 10. In this embodiment, the agricultural machine 10 is configured as a combination of a baler 14, in particular a rotor baler, and an enveloping arrangement 16, that are supported together on the ground by a chassis 18. A towbar 20 is connected to the front of the baler 14, and in turn, is connected to an agricultural tractor, not shown. The baler 14 and the enveloping arrangement 16 are supported on the chassis 18 by means of several struts of which a forward strut 22 and a rear strut 24 are noted. These struts 22 and 24 are located at both sides of the baler 14.

[0019] The enveloping arrangement 16 is located at the rear end of the chassis 18 and is provided with two arms 26 that can rotate together about a vertical axis and each of whose vertical end regions rotatably support a supply roll 28 of enveloping material 40 (see FIG. 2). This enveloping material 40 is wrapped around a cylindrical bale, not shown, as soon as the bale is delivered by the baler 14 and is accepted by a rotary wrapping table 30. The agricultural machine 10, as described up to this point, is described in detail in the German patent application 10 44 166, whose disclosure is expressly incorporated herein by reference.

[0020] As an alternative, the agricultural machine 10 can be configured as an independent wrapping machine or as a rotor baler, in or on which, a roll 28 with enveloping material can be applied.

[0021] FIG. 2 shows a cross section through the enveloping material 40 that is wrapped upon the roll 28. The enveloping material 40 includes a carrier material 42 that consists of a water tight and air tight stretch foil and a coating 44 that contains a preservative. The carrier material 42 is also impenetrable to the preservative. The preservative is fastened to the carrier material 42 by appropriate adhesives contained in the coating 44. The roll 28 with the enveloping material 40 is inserted into the enveloping arrangement 16 in such a way that the coating 44 with the preservative is brought into contact with a cylindrical bale produced by the baler 14. The carrier material 42 generates an anaerobic environment in the bale. The preservative is volatile and penetrates the volume of the bale. Thereby spoilage of the agricultural material in the bale by aerobic organisms is prevented. Due to the increased concentration of the preservative in the outer region of the bale, spoilage is prevented even if a hole or a tear develops in the envelope.

[0022] FIG. 3 shows a section of an agricultural machine which generally coincides with that shown in FIG. 1. While an enveloping material 40 that is in itself porous, is wrapped onto the roll 28, an arrangement is provided for the impregnating of the carrier material 42 with a preservative. This arrangement includes a roll 46 opposite to which a sponge 48 is arranged that is impregnated with a preservative from an appropriate reservoir. The carrier material 42 is drawn between the roll 46 and the sponge 48 so that the preservative is applied by the sponge 48. On the surface located opposite the sponge 48 the carrier material 42 is provided with a thin layer 43 that is impermeable to the preservative, and prevents it from dissipating to the outside. In place of the sponge 48, spray nozzles could also be used.

[0023] Downstream of the sponge 48, the enveloping material 44 that is now ready for application, is conducted between two rolls 50 and 52, the roll 52 here being shown spring loaded against the roll 50, and is used for the enveloping of the bale with the side of the wrapping material which is impregnated with preservative being in contact with the bale. If necessary, the rolls 50 and 52 can be omitted. The arrangement shown in FIG. 3 is applied to each of the arms 26 of the agricultural machine 10, that is, it is present in two locations. After the bale is wrapped, the preservative evaporates at least partially and penetrates the volume of the bale. Undesirable organisms that lead to spoilage of the material in the bale are effectively combated in this way. The concentration of the preservative is greatest at the surface of the bale and that is where holes or tears in the enveloping material 40 are most likely to occur. Obviously, it would also be conceivable that, with the arrangement shown in FIG. 3, such enveloping material could also be wrapped around rolls and used in the machine illustrated in FIG. 1.

[0024] Having described the preferred embodiment, it will become apparent that various modifications can be made without departing from the scope of the invention as defined in the accompanying claims.

1. A wrapping material for enveloping a bale of agricultural material, comprising: a sheet carrying a preservative.
2. The wrapping material, as defined in claim 1, wherein said preservative is contained in a coating applied to said sheet.
3. The wrapping material, as defined in claim 1, wherein said enveloping material has pores; and said preservative being enclosed in said pores of said enveloping material.
4. The wrapping material, as defined in claim 2, wherein said coating defines a surface which is brought into contact with the bale.
5. The wrapping material, as defined in claim 1, wherein said sheet includes an outer layer, as considered when wrapped on the bale, that is not permeable to the preservative and prevents the preservative from diffusing to the outside.
6. In a bale of agricultural material enveloped with a sheet of wrapping material, the improvement comprising: said sheet carrying a preservative.
7. The bale, as defined in claim 6, wherein said bale of agricultural material is a bale containing one of silage or hay.
8. A method of preserving agricultural material, comprising: forming a bale of said agricultural material; and enveloping said material in wrapping material to which a preservative has been applied.
9. In a machine for enveloping bales with a sheet of wrapping material, comprising: a wrapping material supply source; a wrapping material feed path extending between said supply source and a bale to be wrapped; a length of wrapping material extending from said source along said path; and a preservative applicator being mounted along said path for applying preservative to one side of said length of wrapping material.