CORRIGENDUM 1 July 2020

EuPIA Statement on Printing Inks based on Bio-renewable Raw Materials and Biodegradable or Compostable Inks

The terms bio-inks, biodegradable inks and compostable inks are often misunderstood and incorrectly used and therefore they shall be explained in this leaflet.

1. **Inks based on bio-renewable resources**
   Printing inks are usually a mixture of various substances, with functions as colourants (pigments), binders, additives or solvents. Some of these substances can be made of bio-renewable resources, for example some binders, which are based on cellulose or tree gum. Water and any inorganic components are not to be considered being bio-renewable resources.
   For some raw materials also the feedstock used to produce the starting substances (for example monomers like ethylene etc) can be made from bio-renewable resources. A few solvents are available from fermentation processes (for example bio-ethanol), also some substances used as additives such as some waxes can be bio-based. However, colourants (pigments) which are used in printing inks are usually based on fossil resources given the technical needs for light-fastness, resistances etc. which in the overwhelming majority cannot adequately be matched with bio-renewable based colourants (pigments).

   The share of bio-renewable feedstock in substances or a product can be exactly determined according to several scientifically agreed methods. Thus an exact differentiation against feedstock resulting from fossil resources is possible.

   With the bio-balance method the percentage of carbon based on bio-resources can be calculated based on data from earlier steps of the supply chain (raw material producers). The ^{14}C method is using the fact that the amount of the ^{14}C isotope concentration is maximum in living bio-materials and starts slowly to drop after e.g. the harvest of a plant. The drop can be described by the half-life of ^{14}C. Finally the ^{14}C amount in raw materials originating from fossil resources is very low.

   Depending on the ink technology and their application inks with different amounts of bio-renewable carbon are available in the market.

2. **Biodegradation**
   Biodegradation describes the process that under aerobe or anaerobe conditions substances are decomposed by micro-organism mainly to CO_2, water and biomass. This in analogy can be transferred to printing inks.

   There are many standards which describe the measurement of he biodegradation of a substance or an article. The choice of the suitable standard depends on various parameters,

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such as temperature, biodegradation in soil or in a marine environment etc. For compostable packaging materials for example the standards ISO 14851:1999, ISO 14852:1999 are to be used. These stipulate, that in order to pass the test, under aerobic conditions more than 90 % of the organic carbon must be decomposed within 90 days.

Usually printing inks have to fulfil technical specifications to the consequence that they must survive the use cycle of a printed product and remain unchanged. Typically inks are therefore at least partly resistant to such decomposition processes. While some substances like polymeric binders probably may decompose under such conditions, the pigments (and inorganic fillers) used in the printing inks are very stable. The pigment concentration in a dry ink film varies depending on the ink technologies and color shades involved (colored incl. black against white) and ranges from 30-50 % pigments by weight (liquid inks) to 5-20% pigments by weight (UV inks). Hence a considerable part of the dry ink film usually must be considered not to be biodegradable under the conditions of the mentioned standards.

3. **Compostable Products**

Compostability is a characteristic of a product, packaging or associated component that allows it to biodegrade under specific conditions (e.g. a certain temperature, timeframe, etc). These specific conditions are described in standards, such as the European standard on industrial composting EN 13432 (for packaging) or EN 14995 (for plastic materials in general).

Printing inks can be formulated in a way that they do not disturb the composting process of a printed packaging material.
A material which is certified as “compostable” under the standard DIN EN 13432 (there are other requirements existing outside EU), is allowed to contain a small amount of components which are not biodegradable. The sum of components which are not biodegradable must not exceed 5 % by weight. Each of the individual component must not exceed 1 % by weight in the compostable material.
Printing ink layers are normally considered as components which are not biodegradable. Each ink is considered as one individual component. As an example, for a 4 colour print (CMYK) plus white each individual colour must not exceed 1 % by weight and the sum of all colours not 5 % by weight of the printed material (resp. packaging) in order to be certified as “compostable”. Other components of a packaging like e.g. adhesives are to be included in the consideration for the 5 % sum limit for non-biodegradable components in the packaging material.

There are two options for getting printed materials certified as “compostable”:

a. The final printed material must be fully tested according to the standard DIN EN 13432. If the material passes the tests, there is no weight limit on inks or other components. The downside of this options is, that the tests are time consuming and costly. If the print design is changed (ink coverage and/or the ink type) a new test should be performed.

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b. Printing inks (or ink components) can be pre-certified. There are several such programs available (for example: “OK Compost” or “DIN EN 13432 certified Additive”).
In these pre-tests it must be demonstrated that the concentration limits of a number of elements (arsenic, lead, cadmium, chromium, copper[1], molybdenum, nickel, mercury, selenium, zinc, fluorine) are not exceeded in the ink layer applied to the packaging material (whilst considering the 1 % limit) and that the dry ink residuals in the compost do not disturb the germination and growth of two type of plants.
If a printing ink has passed these tests it can be used to produce compostable materials and the printer must only demonstrate that the limits for each ink (component) according to the certificate are met. If a pre-certified substrate is used, no additional tests may be needed and the certification process is quick and with low costs.

Additional remark:

Composting can be done under industrial and home conditions. As inks are usually anyway considered not to biodegrade and they have no negative effect on the composting process there is no difference in suitability of printed materials regarding industrial and home composting.

Compostability is a possibility for design and end-of-life management of certain products including printed packaging. EuPIA members can support their customers in the development of sustainable solutions by providing suitable products. This may help in complying with local, regional or national waste regulations when the printed products are subjected to specific waste collection and waste treatment schemes.

Compostable products are generally not seen as a solution for the (marine) littering problem. It must be clearly mentioned that also a compostable packaging must not be littered into the environment. Compostable materials usually require the treatment in an industrial composting plant and do not degrade in nature or natural environments (soil or aquatic environments). Therefore, the claim of compostability should not be perceived as an invitation for careless discarding of waste into the environment. EuPIA members advocate the implementation of suitable disposal and recovery schemes to protect the environment and to conserve resources.

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[1] Standard blue (PB 15:x) and Green (PG 7) pigments are copper-based. In order not to exceed the strict copper limits in the compostable material of 50 ppm the use of such pigments is usually restricted to very low ink coverage.

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