Association of Manufacturers and Formulators of Enzyme Products

Amfep/10/61 Brussels, 24.09.2010

Amfep Position Paper on Sustainable Use of Enzymes and Modern Biotechnology in the Textile Industry

Amfep position

Industry welcomes sustainable textile production. However, organic standards limit sustainable development based on enzymes and modern biotechnology.

Organic certification and branding appears to be used as a sustainability driver and the inherent ban on enzymes produced with the help of genetically modified microorganisms (GMMs) may not be known or demanded by the consumer.

In textile context, the public perception of organic and 'natural' is generally that cultivation and processing is free of chemicals harmful to man and environment – modern enzyme technology should therefore be promoted to reduce use of harsh chemicals.

Ecolabelling schemes widely recognise use of enzymes produced with the help of GMMs. Manufacturer specifications secure absence of the GMM in the enzyme product.

Some schemes and standards have adopted similar specifications and distinction is made between GM crops like cotton and processing aids like enzymes produced with the help of GMMs under containment.

Enzymes and textile processing

Use of enzymes in the textile industry has evolved from desizing with amylase to a wide range of fibre and fabric processing applications, comprising enzymes particularly developed for this sector. They are now used to remove natural impurities in fibres, and in surface treatment, bleaching, and colour adjustment of fabrics. Due to the high efficiency and specificity of enzymes, processes as well as textile product quality can be improved. Energy, water consumption, and CO_2 emissions can be reduced. Enzymatic treatments of cotton/denim, wool, and silk enable substitution of chemicals of concern to workers, consumers and the environment.

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Improved sustainability through modern biotechnology

Today's development and production of cost-effective industrial enzymes is depending on use of modern biotechnology (gene technology).

For enzyme production this means use of Genetically Modified Microorganisms (GMMs) kept under containment. This way, no GMMs are released into the environment.

Enzyme preparations contain no GMMs but only the desired enzyme activity for specific applications. Better enzyme production efficiency is obtained by lowering use of water, energy, and CO_2 emissions per unit of enzyme. In textile industry applications, improved performance can be achieved at lower temperatures, at neutral pH with less rinsing water, at lower enzyme dosages with less waste emissions and associated cost, and with new processes replacing undesirable chemicals.

Organic certification and branding of textiles

Sustainable technologies and products are demanded by the textile industry and consumers. To this end, organic certification and branding of textiles has become a marketing tool and 'organic' is largely perceived by consumers as a sustainability indicator. However, use of gene technology is generally not compatible with the 'traditional' element of criteria for organic agriculture and food production. Organic certification, even unintentionally, may therefore limit sustainable development if enzymes produced by modern biotechnology cannot be used.

The Global Organic Textile Standard 'GOTS' (http://global-standard.org) is an organic certification scheme for cotton and textile with specific criteria not allowing use of enzymes produced with the help of GMMs (including self cloned microoorganisms [1]).

In the textile sector, such organic branding may limit or prevent introduction of new enzymes otherwise offering acknowledged benefits for consumers, the environment and in terms of occupational safety.

In our opinion, microbial enzymes as such cannot be claimed organic or not, since they are non-agricultural products and therefore out of the scope of organic production as defined in Art. 1.2 of EU Regulation 834/2007 on organic production and labelling (http://ec.europa.eu/agriculture/organic/eu-policy/legislation_en). Textile production and processing itself is also not within scope of EU Regulation 834/2007, however, organic textile schemes require adherence to this Regulation for the natural vegetable fibres (e.g. cotton) used in textiles. That means that the cotton used to manufacture the textile cannot be made from GMO cotton.

Standards allowing enzymes produced with the help of GMMs in textile processing

Enzymes produced with the help of GMMs can be used in compliance with the EU Ecolabel for textiles
http://ec.europa.eu/environment/ecolabel/index_en.htm

[1] Defined in EU Contained Use Directive 2009/41/EC

Enzymes produced with the help of GMMs can be used in compliance with the Nordic Ecolabel for textiles

http://www.svanen.nu/Default.aspx?tabName=CriteriaDetailEng&menuItemID=7056&pgr=39

Enzymes produced with the help of GMMs can be used in compliance with the Öko-Tex standard http://www.oeko-tex.com/OekoTex100_PUBLIC/index.asp?cls=02

Sustainability demands for textiles typically relate to avoiding pesticide residues, dangerous chemicals in textile processing, child labour etc. Most consumers are not aware of or demanding the generally strict non-GM criteria in GOTS or similar schemes.

Use of enzyme produced with the help of GMMs in other products than textiles

Enzymes produced with the help of GMMs are used in almost all industrial sectors, including the food and feed industries.

Also in other industries, such as the detergent industry, the pulp and paper industry, as well as in the biofuels industry there is broad acceptance of the use of enzymes produced with the help of GMMs as processing aids.

Examples of sustainable benefits using enzymes produced with the help of GMMs by Amfep companies

Pectate lyase

Conventional scouring uses high concentrations of sodium hydroxide and surfactant to remove the waxes and hemicelluloses in the primary cell wall layer of cotton. BioScouring is a process which using an enzyme, pectate lyase, as the major component in scouring cotton textiles. It degrades pectin which is believed to be the glue that binds the natural waxes of cotton to the fibre.

By using 10 kg of pectate lyase product for one ton of cotton yarn, 40 kg of hydrogen peroxide, 15 kg of sodium hydroxide, 5 kg of acetic acid, 2500 kg of steam, 150 kWh of electricity, 20 m^3 of water are saved while yielding 25 kg more of yarn. This contributes to around 1000 kg of CO_2 emission in processing one ton of yarn for dark shade dyeing. The total CO_2 reduction potential in China corresponds to the annual emission from around 50,000 cars.

The use of a GMM enables the net reduction of CO_2 emission:

The production yield of pectate lyase produced with the help of non-GMM is in the range of mg/L, by applying GMM technology, the yield has been improved to g/L which enables to limit the CO_2 emission to 1-10 kg for producing 1 kg of enzyme.

As a result, the net reduction of CO2 emission against conventional scouring is around 100 kg/kg enzyme.

Cellulase

In the table below, three enzymes used in similar applications are compared, one produced with the help of a non-GMM, the other two produced with the help of GMMs.

The sustainability benefits at the manufacturer site are less energy and water consumption and less CO_2 emission during enzyme production. The sustainability benefits at the textile processor's site are also less water and energy consumption, because the enzyme has been optimized for such conditions, and lower waste emissions, because the GMM based products' purity is higher.

Product	GMO	Water use per kg (indexed)	Energy use per kg (indexed)	Direct CO_2 emission per kg (indexed)	Application temperature	Application pH	Biodegradability	BOD/kg enzyme product (indexed)
Cellulase A	No	100	100	100	50-60 ^{o}C	5.0-5.5	100%	100
Cellulase B	Yes	47	80	48	30-50 ^{o}C	5.5-6.5	100%	13
Cellulase C	Yes	38	65	51	50-70 ^{o}C	4.5-5.5	100%	20

Comparison of sustainability parameters of enzymes based on GMMs vs. non-GMM (non-GMM product has been set to 100). Water, energy and CO_2 emissions refer to the enzyme production process; application parameters and waste values refer to enzyme use by the textile processor. BOD (Biochemical Oxygen Demand) is a measure for organic water pollution.

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