Request for exemption of the authorisation requirement for the use of Cobalt(II) sulphate as a nutrient supplement in biogas production processes

European Chemical Agency (ECHA) announced its proposal for the prioritisation of cobalt(II)sulphate on the Candidate List that may become subject to Authorization under the REACH legislation. Cobalt(II) sulphate is used in small amounts in biogas production processes as a nutrient additive necessary for the metabolism of the methanogenic bacteria in the process.

We would like to ask an exemption for cobalt(II) sulphate ($CoSO_4$) used as a process additive in biogas production processes.

Cobalt is an essential nutrient – Occurrence in the environment

Cobalt is an element that occurs naturally in many different chemical forms throughout the environment. It is a natural earth element and is present in trace amounts in most rocks, soil, surface and underground water, plants and animals. Although the average level of cobalt in soils throughout the world is 8 $mg.kg^{-1}$ (dry matter) there are soils with as much as 70 $mg.kg^{-1}$. All natural waters contain trace levels of cobalt, drinking water contains between 0.1 and 10 ppb. All the cobalt used in the industry has been subtracted from the environment.

The element Cobalt is a component of vitamin B_{12}, which is essential for human and animal health. The total daily intake of cobalt in humans may be as much as 1 mg, but almost all will pass through the body unabsorbed, except cobalt in vitamin $B_{12.}$ Cobalt is not accumulating in mammalian tissues.

Cobalt is essential for nitrogen fixation by free-living bacteria, blue-green algae, and symbiotic systems. In the marine environment cobalt is needed by blue-green algae (cyanobacteria) and other nitrogen fixing organisms. In higher plants, cobalt has been shown to be an essential element for legumes, which have nodules containing nitrogen-fixing bacteria. Cobalt plays an important role in metabolism of methanogenic bacteria, one of the oldest organisms on the Earth.

Use of cobalt(II) sulphate in biogas production processes

Biogas production process is a common technology used for degradation of complex organic materials (such as sewage sludge, bio-waste, energy crops) to produce energy-rich gas, called biogas and a fermentation residue, so called digestate. Biogas is an important renewable energy source within Europe. Current European production is 8,346 thousands of tonnes of oil equivalent per year

(Eurobserver, 2009). Biogas is a methane-based energy carrier widely used for delocalized electricity and heat production (CHP). Treated biogas is also used as a renewable replacement of natural gas. Only Germany itself is targeting to replace 6 billions cubic metres per year of natural gas with treated biogas by 2020. Biogas production is mature technology and its potential was acknowledged in National Renewable Energy Action Plans, where biogas plays an important role.

Biogas production is also an important part of sustainable agriculture in Europe. Biogas production can utilize manure from all the kinds of farm animals. Utilization of manure in biogas processes efficiently avoids ammonia and nitrous oxides emissions which are prone to be emitted from open manure storages. Sustainable agriculture also benefits from the fermentation residue (digestate). Digestate is returned to the agricultural fields, bringing back all the nutrients taken away by the plants and removed during the harvest. Use of digestate efficiently reduces or even avoids the use of artificial fertilizers on the digestate-fertilized fields.

In biogas production processes, micro-organisms grow on organic material that contains certain level of nutrients, minerals and trace elements. Especially the natural content of the trace elements is a limiting factor for a successful development of bacterial culture needed for efficient biogas production. The special need for higher amount of trace elements originates in methanogenic bacteria metabolism and its pathways. These pathways utilize a number of unique enzymes which contain elements such as iron, copper, zinc, cobalt, manganese, molybdenum, nickel, selenium, vanadium, and tungsten. Efficient supplement of these trace elements is crucial for bacterial cell growth and reproduction. Cobalt(II) sulphate is commonly used as a source for cobalt.

Safe use of small amounts of cobalt(II) sulphate

Small amounts of cobalt(II) sulphate (order of grams) are placed in sealed biodegradable bags directly into the substrate dosing unit of the biogas reactors. The equivalent amount of trace elements may also be dosed in a liquid form. In such a case a solution of cobalt(II) sulphate is added continuously into the biogas reactor. The dosing unit is often an integral part of the biogas process technology. Typical concentrations of this liquid stock solution lie in the range of 0,2 to 3 g/L. Final concentrations in digestate range from 1-10 ppm (parts per million).

For the handling of $CoSO_4$ containing nutrition additives, the necessary safety precautions are in place. The operators are trained and are complying with the national health and safety laws.

At the end of the biogas process, the remaining organic matter and the microbial biomass is removed from the biogas reactors. This remaining mixture called digestate is aerobically stable, with no obvious smell, and due to the process temperature is also hygienized. Digestate is used as an agricultural fertilizer. Small amounts of trace elements are thus recycled back to the agricultural

soil. Recycling of trace elements efficiently reduces/ avoids the need of additional artificial fertilizers application.

As already mentioned, the biogas process industry uses only small amounts of cobalt(II) sulphate, resulting in a very limited discharge of cobalt residue in the environment. As far as toxicity is concerned, this will not pose any additional risk to man and environment. For information, the global production of cobalt is about 17,000 tons per year.

The use of cobalt(II) sulphate is covered by the Directive 2004/37/EC: Carcinogenic and Mutagens Directive, Directive 92/85/EEC Pregnant Workers Directive and Directive 94/33/EC Protection of Young Workers at the Workplace. These Directives (especially 2004/37/EC) aim the reduction and replacement of carcinogens and mutagens in so far as technically possible and prevent and reduce the exposure to these products.

The discharge of liquid waste via water treatment installation is covered by the Directive 2000/60/EC Water Framework Directive and Directive 2008/105/EC.Cobalt and corresponding compounds are not listed in Annex X (list of priority substances in the field of water policy).

The discharging of chemical waste is covered by the Waste Framework Directive (2006/12/EC, revised by 2008/98/EC).

Irreplaceable function of Cobalt(II) sulphate

Cobalt(II) sulphate is an indispensable element of methanogenic bacteria metabolism, as it is the source of the trace element Cobalt. Cobalt is needed as a catalytic element for chemical reactions catalyzed by various Cobalt-based enzymes. For example, it is necessary to start the cell division and it is a component of Vitamin B12. There is no possible alternative to perform the same function. As such, it is an irreplaceable component in biogas production processes.

Authorization exemption

Biogas production and utilization is an integral part of many environmental technologies like sewage sludge treatment, bio-waste treatment and also an important part of agricultural manure treatment in sustainable agriculture. Furthermore biogas utilization is an important pillar of the European bioenergy policy. The near term goals of biogas development are defined in National Renewable Energy Action Plans in all the 27 Member States.

To be able to develop and to sustain the biogas industry in Europe, an exemption from authorization is asked for the use of cobalt(II) sulphate in biogas production processes, as the use of this salt is adequately controlled within the sector.

The use of cobalt(II) sulphate trace element additives within the biogas sector is limited to low quantities. Only small amounts are being used in each separate facility. The use is limited to industrial users and already covered by very strict regulation concerning protection of workers (such as Directive 2004/37/EC: Carcinogenic and Mutagens Directive, Directive 92/85/EEC: Pregnant Workers Directive and Directive 94/33/EC: Protection of Young Workers).