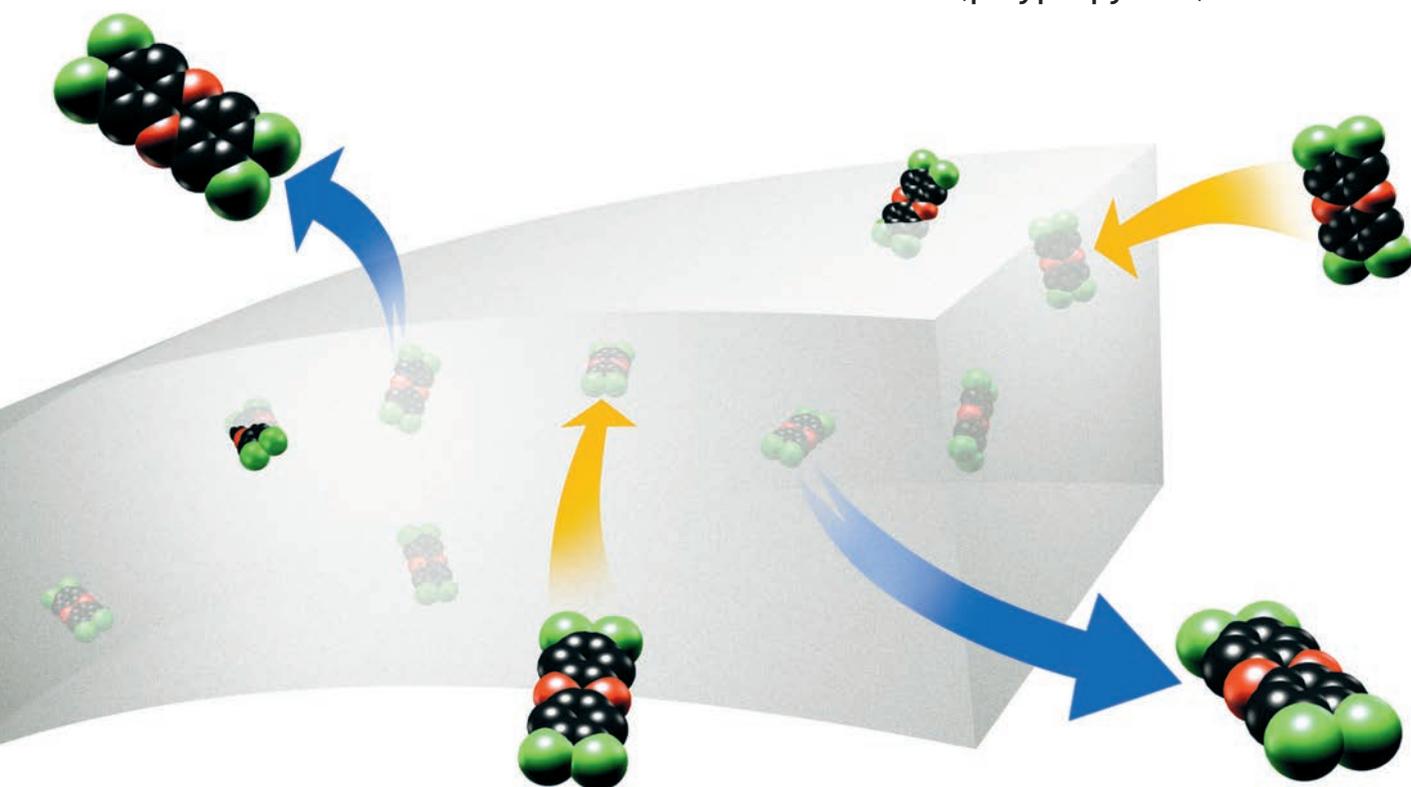


ADIOX®
- a leading
technology
to reduce
emissions of
DIOXINS

Dioxins and PP (polypropylene)



Memory Effect

Dioxins are easily absorbed from flue gases into plastic materials such as polypropylene (PP), which is commonly used in wet flue gas cleaning systems. Inside the plastic material, the dioxin molecules tend to migrate. Both the absorption and the migration processes are strongly temperature dependent.

If the conditions change, and the dioxin concentration in the flue gas decreases, or if the temperature raises by only a few degrees, dioxins in the plastic will migrate to the surface and be released back into the flue gas. This increase in the dioxin content of flue gas is known as the "Memory Effect".

Facts about Dioxins

What is commonly referred to as "dioxins", or PCDD/F, is a group of polychlorinated molecules called dioxins and furans.

The most toxic is "2,3,7,8-TCDD" (or 2,3,7,8-Tetrachlorodibenzo-p-dioxin), to which the toxicity of other molecules in the group is often related. TEQ (Toxic Equivalents) can be calculated by adding up the amounts of some specified dioxins and furans weighted with toxicity factors, where 2,3,7,8-TCDD equals 1. European regulations stipulate that emissions are less than 0.1 ng TEQ/Nm³. Dioxins are of a very stable nature and accumulate as they move up the food chain to humans. The high toxicity of dioxin is due to the fact that it can interact with the DNA molecule. Since 1997 the World Health Organisation has recognised 2,3,7,8-TCDD as carcinogenic for humans.

Full-scale operation

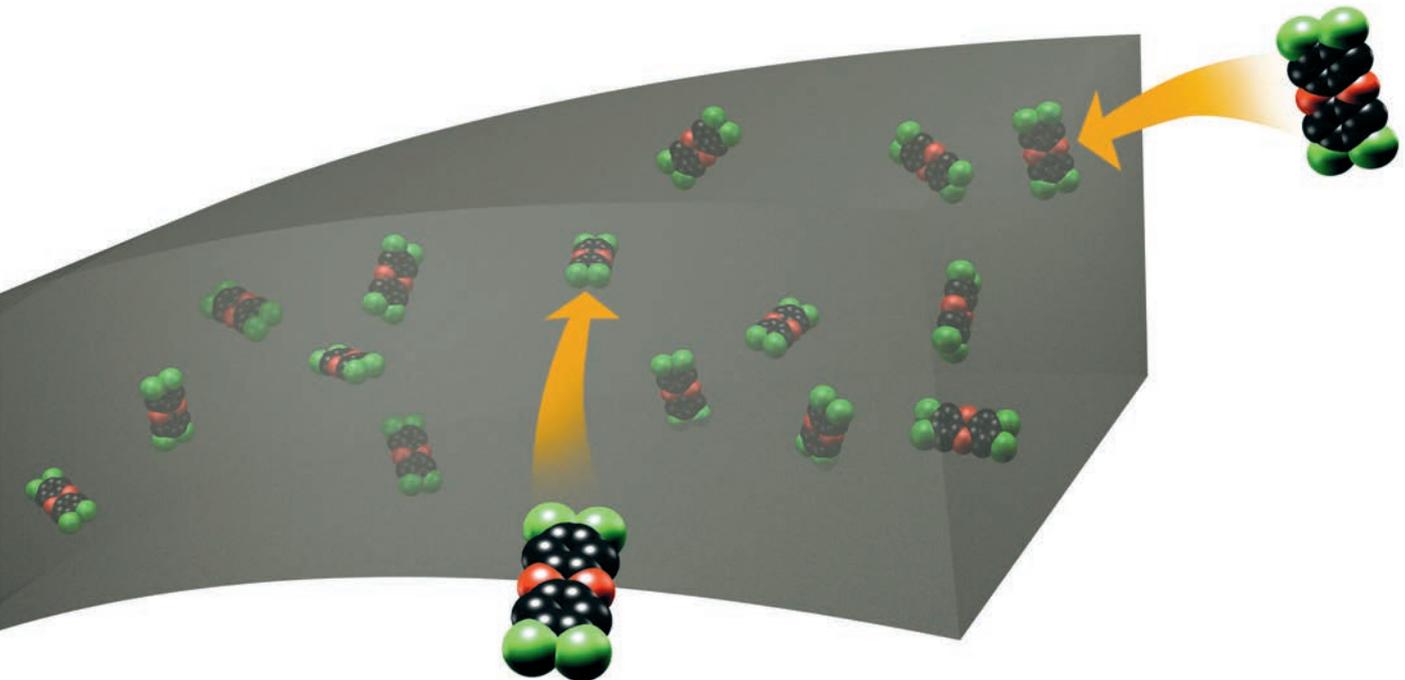
The ADIOX[®] technology has been successfully used since September 2001. Typical applications are wet flue gas cleaning after waste incineration. The material is introduced as tower packing and demisters/droplet separators in wet scrubbers.

The ADIOX[®] tower packings are developed for high performance dioxin separation, combined with the material properties required for good function and lifetime of tower packings.

As per autumn 2008 approximately 65 full-scale installations have been started up in 14 countries, applying the ADIOX[®] technology for reducing emissions of dioxin.

ADIOX[®] can also be applied in dry reactors typically preceded by a wet system and a reheater or in semiwet absorbers installed directly after, or integrated in, a scrubber system.

Dioxins and the ADIOX®



Efficient dioxin removal and no re-emission

The ADIOX® process is based on the high affinity of dioxins to carbon - when in contact, the bond between dioxins and carbon is very strong. By dispersing small particles of carbon in PP-plastics, a material excellent for dioxin abatement is formed.

A dioxin molecule present in the flue gas is first absorbed into the PP, where it migrates to a carbon particle, on which it is very strongly adsorbed (connected to its surface). The plastic material acts as a selective filter with a preference for molecules like dioxin.

Since the affinity for carbon is so high, there is no tendency for the dioxin molecules to be released, even when the concentration in the flue gas decreases. Therefore, the Memory Effect is minimized!

The ADIOX® technology (patented) is related to the composition of the material (carbon-filled PP). The form and shape of the material chosen for a specific installation depends on where in the process it is applied - and on the process conditions. Typical examples are tower packings and droplet separators.

Several incineration plants have now operated very successfully for many years with ADIOX® as the only dioxin removal technology.



Advantages

Advantages of the ADIOX® technology for dioxin abatement include:

- Efficient dioxin removal, also during start-up conditions.
- Memory Effect can be minimized
- Non complex systems
- Minimal maintenance
- High availability
- Clean handling
- Safe disposal, the material is incinerated after years of use and the dioxins are thereby destroyed.
- Applied as ordinary components with additional function
- Low cost for reducing emissions of dioxins
- Easy installation

Applications

The ADIOX® technology can easily be introduced in new or existing plants as tower packing in wet scrubber systems, semiwet absorbers or in dry reactors. By applying the ADIOX® material in plastic components of the flue gas cleaning system, the Memory Effect can be minimized. By installing ADIOX® at the end of the cleaning system, it operates supplementary to other dioxin abatement systems. It will then be acting as a back-up system for problems such as leakage or coal-dosing failure, and at installations experiencing problems with the Memory Effect.

ADIOX® can be used in combination with other dioxin abatement systems for optimisation of the system, and allowing reduction in continuous dosing of carbon. It can also be applied as unique dioxin filter in wet or dry gas conditions. The solution chosen depends on the conditions of the actual installation.

Since the ADIOX® material is applied in the form of normal components, the scrubber system can be designed to be multifunctional, combining dioxin removal with e.g. HCl-reduction and condensing for energy recovery.

The ADIOX® technology can be applied wherever emissions of dioxin need to be reduced. Obvious applications are in the flue gas cleaning system for incineration of:

- Household waste
- Industrial waste
- Hazardous waste
- Sludge

The ADIOX® technology could also be applied in other processes where dioxins are present in the gas phase.

Forschungszentrum Karlsruhe

The Forschungszentrum Karlsruhe is one of the largest non-commercial science and engineering research institutions in Germany. It works on research and development problems of public interest, in the fields of technology and environment.

The application-oriented activities of the Centre comprise all stages of research, from basic findings to pre-product development. The Centre is regarded to be internationally in the absolute forefront in the areas of aerosol-, mercury- and dioxin research.

Götaverken Miljö AB

Based on dioxin research of the Forschungszentrum Karlsruhe, the Swedish company Götaverken Miljö has developed products and systems using the ADIOX® process for reducing emissions of dioxins.

The cooperation with the Forschungszentrum Karlsruhe also includes the MercOx process, for reduction of emissions of mercury. The MercOx process is based on hydrogen peroxide being used in a scrubber system to reduce emissions of mercury.

Götaverken Miljö offers both the ADIOX® and the MercOx solutions to the international market.

Being an established engineering and contracting company for systems within the fields of environment and energy, Götaverken Miljö is an experienced supplier of flue gas cleaning systems, large heat pump/chiller systems and energy recovery systems.

For further information, please contact:



Götaverken Miljö AB

Visiting address: Anders Carlssons gata 14
Postal address: Box 8876, SE-402 72 Göteborg, Sweden
Telephone: +46(0)31-50 19 60, Fax: +46(0)31-22 98 67
www.gmab.se

