UMTEC
Institut für Umwelt- und Verfahrenstechnik

"We don't study technical problems. We solve them!" UMTEC

EIN INSTITUT DER
HSR
HOCHSCHULE FÜR TECHNIK
RAPPERSWIL

MISA POR®

Water Treatment with Iron Modified Foam Glass

Removal of:

- Cu, Zn, As, Sb (proven effect)
- Organics (possible/ likeley effect)

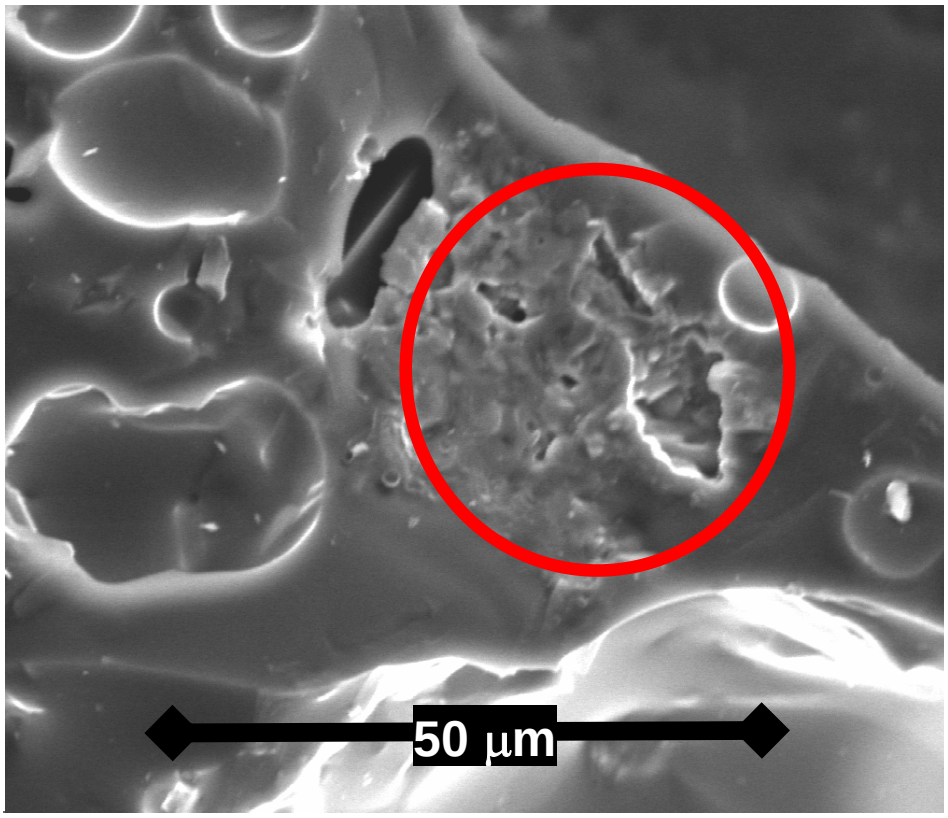

Fig. 1: Foam-Glass with iron particle inclusions.

Subject: Contaminated Water

Contaminated Water is a problem of global proportions. Examples are:

Acid Mine Drainage - Acidic wastewater leaking from abandoned mines or dumps contaminates vast areas with heavy metals.

„Natural" Ground Water - Millions drink water from arsenic contaminated wells, for example in Bangladesh.

Industrial Wastewater - A great demand exists for efficiently removing heavy metals from industrial wastewater without the installation of an entire treatment plant.

Persistent Organics - Many organic contaminants cannot be broken down by biological treatment alone and result in residual COD. For example: endocrine disruptors.

FERROPORE

UMTEC
Institute for Environmental and Process Engineering
Oberseestrasse 10, 8640 Rapperswil
Tel. 055 222 48 60, Fax 055 222 48 61
info@umtec.ch, www.umtec.ch

Background

Contaminated water is a pressing global problem. Examples are acid mine drainage, arsenic contaminated drinking water and industrial wastewaters. In addition to water containing poisonous metals, the problem of persistent organics, in particular endocrine disruptors, becomes a serious problem of rapidly increasing extent.

FERROPORE

UMTEC, the "Institute for Environmental and Process Engineering", and MISAPOR, the leading producer of foam-glass in Switzerland, have jointly developed a solution for wastewater treatment: FERROPORE. FERROPORE is suitable for the treatment of metal contaminated waste waters, in particular such containing copper, zinc or arsenic. The foam-glass is produced by heating a mixture of waste glass powder, iron powder and a foaming agent to approximately 900°C. The foaming agent then releases a gas thus forming bubbles within the molten glass. After solidification this foam-glass contains approximately 1 million pores per cubic centimetre. Despite high porosity, the foam-glass is extraordinarily firm and resistant against abrasion. FERROPORE is then granulated to 0.5-2mm and packed into columns or cartridges which are percolated by the water to be treated. The iron particles are fixed on the surfaces of the foam-glass. They offer a variety of mechanisms that can be exploited for waste water treatment, in particular adsorption (of heavy metals) and catalytic reactions (e.g. Fenton's reaction with H2O2).

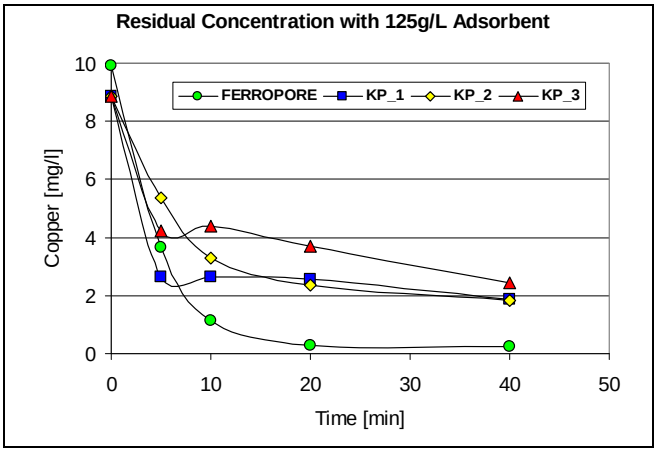

Fig. 2: Results of a "Show-Down" between FERROPORE and three "conventional" adsorbents. Waste water contaminated with 10mg/l copper at pH 4: 125g/l adsorbent was added.

Results

Figure 2 shows that after 20 minutes approximately 97% of the copper had been removed by FERROPORE, while the other adsorbents had removed only about 65-75% of the copper from solution.

In Fig. 3 the copper residual concentration is shown after only 2g/L adsorbent had been added. Clearly, FERROPORE removes copper faster and more completely than the competing product. We have shown that the adsorption of heavy metals on FERROPORE is irreversible under virtually all scenarios typically encountered in waste water treatment.

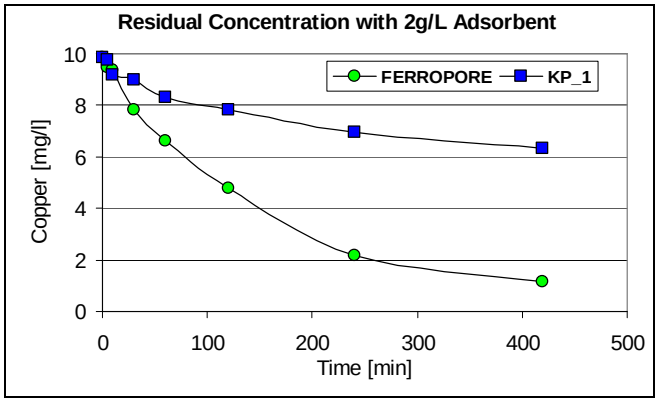

Fig. 3: Residual copper-concentration with 2g/L adsorbent

Advantages of FERROPORE

One great advantage of FERROPORE over conventional iron-hydroxide adsorbents is the superb mechanical stability and abrasion resistance.

This makes it suitable for the use in sand-filters, instead of conventional "sand" such as quartz or pumice. Obviously, mixtures of iron powder and quartz, which are also occasionally used for water treatment, cannot be applied in sand-filters because such mixtures would separate after back-flushing. As the iron is fixed on the surface of FERROPORE, such separation is avoided.

While the potential of FERROPORE for the adsorption of heavy metals from acidic waters has been well proven, the possible catalytic properties have not yet been investigated. One project is currently under way together with the municipality of Zürich, to assess the potential of using FERROPORE in sand filters as a fixed bed iron catalyst for the treatment of endocrine disruptors with H2O2 (Fenton's reaction).

Over competing iron-based materials for waste water purification, FERROPORE exhibits the following advantages:

- Excellent adsorption capacity down to pH 3
- Low cost
- Excellent mechanical stability and resistance to abrasion
- Adsorption is practically irreversible (easy disposal of the spent product)
- pH-neutrality, strong buffering capacity around pH 5
- potential for catalytic reactions, for example Fenton's