

Characterisation of inhalable aerosols from carbon fibres

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Carbon fibres (CF) and CF-reinforced plastics (CFRPs) are innovative materials, which are increasingly produced, recycled and disposed, possibly releasing particles and fibres. The BMBF project "Carbon Fibre Cycle – CFC" has the aim to identify respirable particles, fibres and fibre fragments after thermal and mechanical treatment of CF/CFRP, to analyse them and to assess pulmonary toxicity. The physical properties of CF being similar to asbestos raise serious concerns about potentially harmful effects in the lung.

Inhalable aerosols of mechanically or mechanical-thermally treated CF are provided and characterized, which are deposited at the air-liquid interface onto human lung cells in an exposure system, where toxicological investigations are carried out, i.e. directly on the apical surface of cell cultures, in order to simulate lung-like conditions. Lung epithelial cells and macrophages in mono and co-culture are used for toxicological evaluation of respirable CF fragments focussing on determination of cytotoxicity, gene expression analyses and determination of proinflammatory, profibrotic and genotoxic potential.

Commercial short carbon fibres based on polyacrylonitrile (PAN) were investigated after mechanically or mechanical-thermal treatment. The aerosol from the exposure system was on the one hand sampled on filters which were analysed by different microscopy methods and on the other hand the deposited dose on the cell surfaces was measured. All images from digital and scanning electron microscopy were evaluated using the image analysis software FibreShape (IST AG, Switzerland) in combination with own data post processing. The fibres were analysed regarding length, diameter and in a further step the aerodynamic equivalent diameter was calculated. Fibre characterisation is discussed in the context with biological responses caused by inhalable CF.

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