Comparison of dissolution/absorption profiles of CuO and Cu nanoparticles by using the *in vitro* dissolution ranking tool Dissolv*It*®

Malmlöf, M.[1,2], Nowenwik, M.[2], Gerde, P.[1, 2] and Karlsson, H. L.[1]
[1] Institute of Environmental Medicine, Karolinska Institutet, Sweden, [2] Inhalation Sciences, Sweden

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Conclusions

Dissolv*It* could be used for dissolution testing of nanoparticles.

Introduction

The increased production and use of nanoparticles lead to a need for performing risk assessment of different materials. The most common exposure route for nanoparticles is inhalation. One critical aspect of understanding the risk is knowledge about the dissolution kinetics in the lungs.

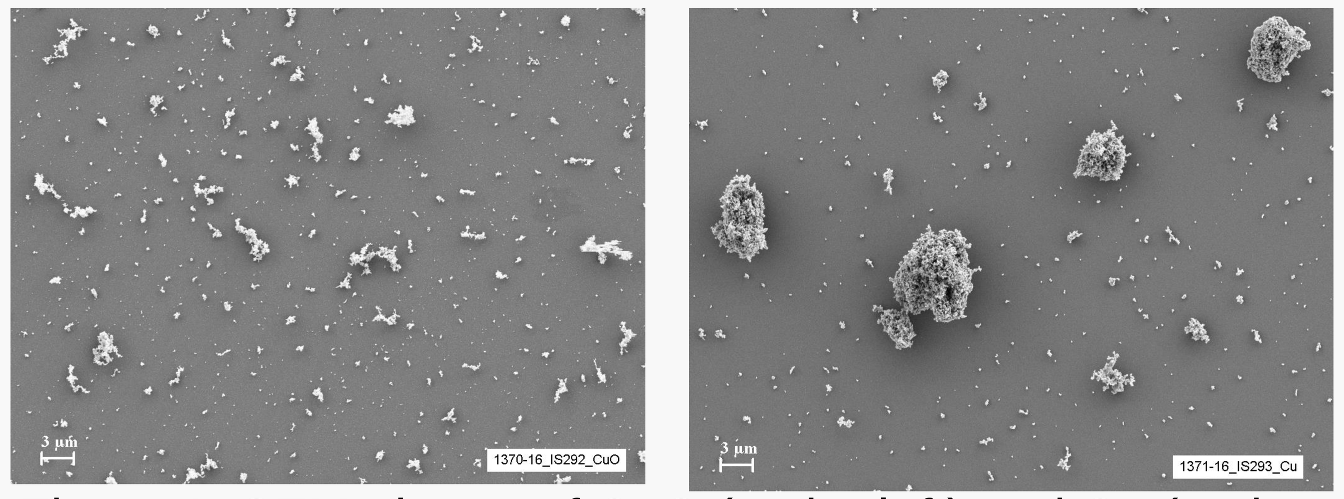


Figure 1. SEM photos of CuO (to the left) and Cu (to the right) deposited on glass cover slips.

Aim

The aim of this study was to test a recently developed *in vitro* dissolution system called Dissolv*It*, that mimics the air-blood barrier in the upper airways, and furthermore, to generate dissolution/absorption profiles of CuO and Cu nanoparticles.

Methods

The PreciseInhale® aerosol generator was used to generate dry powder aerosols of CuO and Cu nanoparticles and deposit the aerosols on glass cover slips (2.1 µg CuO and 4.7 µg Cu respectively) (figure 1).

Dissolv*It* consists of (from bottom to top) a glass cover slip with well distributed particles (facing upwards), a mucus simulant in which the particles are dissolved. The mucus simulant is distributed over a polycarbonate membrane (representing the basal membrane in the airways). On the other side of the membrane a phosphate buffer containing 4 % albumin (pH 7.4) is pumped (simulating the blood) absorbing dissolved constituents of the particles.

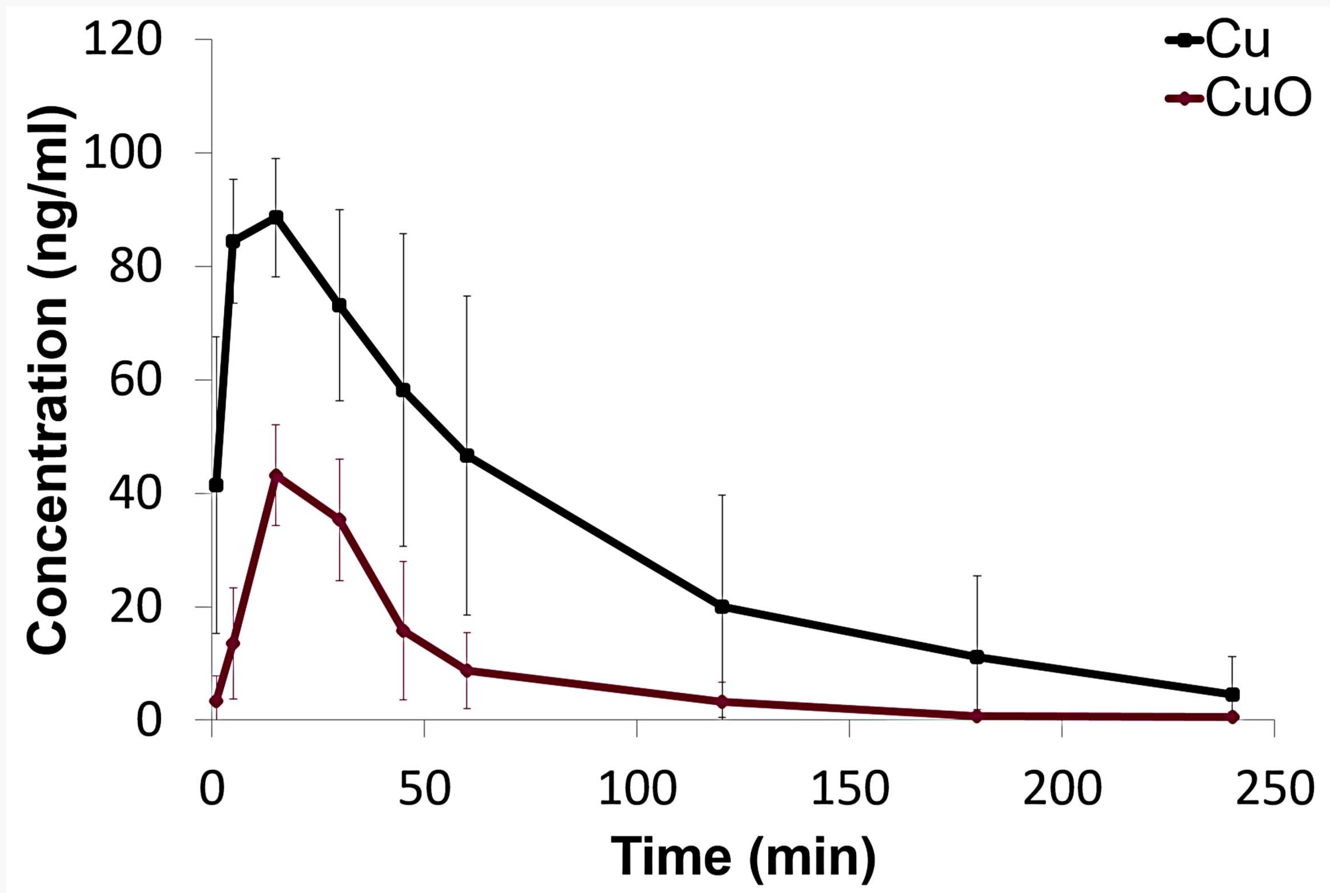


Figure 2. Dissolution/absorption profiles of CuO and Cu.

Fractions of the perfusate are collected over time (4 h), and later analysed using inductively coupled plasma mass spectrometry (ICP-MS).

Exposure material	C_{max} (ng/ml)	t_{max} (min)	Exposure material	C_{max} (ng/ml)	t_{max} (min)
CuO, exp 1	45	30	Cu, exp 1	96	15
CuO, exp 2	37	30	Cu, exp 2	93	15
CuO, exp 3	52	15	Cu, exp 3	77	15
Average	**45**	**25**	**Average**	**89**	**15**
SD	8	9	SD	10	0
%SD	17	35	%SD	12	0

Table 1. C_{max} and t_{max} values for CuO and Cu nano particles generated in the *in vitro* lung simulating dissolution system Dissolv*It*.

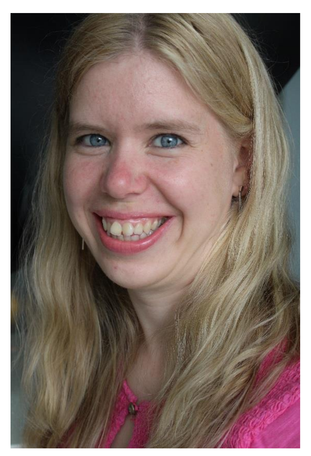
Results

We found CuO easier to aerosolize than Cu. The CuO particles were more easily de-agglomerated and tended to re-agglomerate less in the aerosol (figure 1). Both types of nanoparticles dissolved rather rapidly in the simulated air-blood barrier (figure 2). Analysis of the perfusate samples indicated that the absorption of CuO was faster than for Cu (table 1).

Further investigations will reveal the full potential of using Dissolv*It* as a tool in toxicology research.

COI: MM, MN and PG have stocks in Inhalation Sciences.

Inhalation Sciences
Laboratory Manager *in vitro* Studies
Hälsovägen 7-9
141 57 Huddinge, Sweden
maria.malmlof@inhalation.se
www.inhalation.se



Karolinska Institutet
Institute of Environmental Medicine
PhD student
Box 210
171 71 Solna, Sweden
www.ki.se/imm