PRODUCTION OF QUARTZ POWDERS WITH REDUCED CRYSTALLINE SILICA TOXICITY. PRELIMINARY RESULTS

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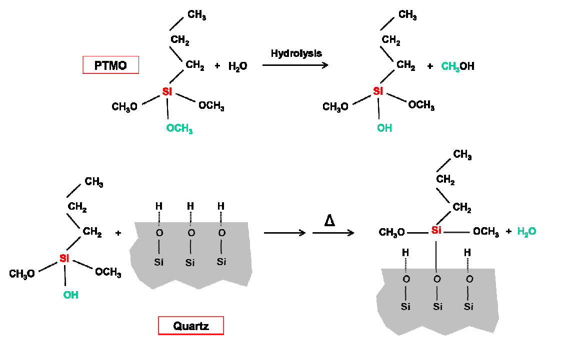
Silife

LIFE14 ENV/ES/000238

Background and objectives

The SILICOAT project aimed developed and implemented cost-effective respirable crystalline silica (RCS) coating technologies based on stable, covalent saturation of reactive quartz surface silanol groups, into ceramic processes to inhibit quartz-specific toxic effects. The coating technology developed in SILICOAT was demonstrated for traditional ceramics, in wet-process stages, but it was not applied elsewhere. The project evidenced that the coating technology developed, should optimally be introduced upstream, when the quartz powders are produced (by dry process), to be used by different industrial sectors.



The aim of the SILIFE project is producing commercial quartz powders that show very little or no RCS toxicity, with the following main goals: 1) Pilot plant for quartz treatment, 2) technical and economical feasibility, 3) reduction of quartz toxicity and 4) full product quality.

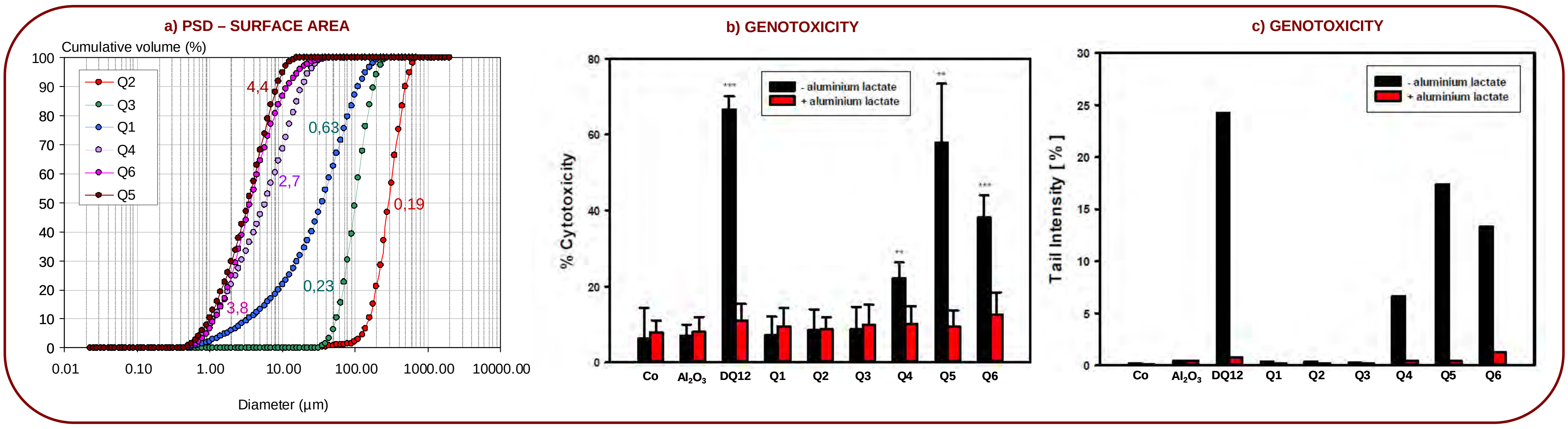
Consortium

The SILIFE consists of eleven members, as detailed in the following table:

Technological beneficiaries	Industrial beneficiaries	
	Raw material suppliers	End users
R&D performers: IUTC-Universidad Jaume I (Coordinator) Fraunhofer ITEM Centro Ceramico di Bologna (CCB) **Technological Plattform:** Spanish Technology Platform on Industrial Safety (PESI)	ABCR Laboratorios S.L. (Silanes producer) Bulk Cargo Logistics S.A. (Quartz processor)	Elastomers Union S.r.l. (Elastomers producer) ESMALGLASS S.A.U. (Frits and glazes producer) Fundiciones FUMBARRI-DURANGO S.A. (Steel foundry) ITACA S.A.U. (Inorganic pigments producer) MAPEI S.P.A. (Adhesives producer)

Preliminary results

Quartz samples supplied by the industrial associates of the project (end users and quartz supplier) were characterised. The particle size distributions and surface areas in m^2/g (coloured numbers) are shown in the figure a). In figures b) and c), the results of LDH release (cytotoxicity) and DNA damage (genotoxicity) are shown, compared to those of culture medium (Co), Al_2O_3 (negative reference) and quartz DQ12 (positive reference).



Discussion

Sample/Treatment	S_e [m^2/g]	Volume < 4 µm [%]	Cytotoxicity [%]	Genotoxicity [%]
DQ12	3.70	-	56	24
Q5	4.40	57.4	48	18
Q6	3.80	54.5	26	12
Q4	2.70	39.6	12	6
Q1	0.63	11.3	<3	<0,5
Q3	0.23	0.0	<3	<0,5
Q2	0.19	0.0	<3	<0,5

Conclusions

- For the studied samples, the intrinsic toxicity has a clear relationship with the physical characteristics (surface area and particle size distribution).
- It should be highlighted that coarser quartzes with low surface area have shown very low or null RCS toxicity, which increases with surface area.
- Some sectors using these coarse quartzes have reported RCS problems derived from workers exposure to high concentrations of RCS. This behaviour can not be explained by the previous results. Therefore, this toxic respirable dust is presumably generated by some thermal and/or mechanical quartz treatments developed during the production process.
- These foundings suggest that all processes using quartz should be carefully studied.

Acknowledgements

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