

**International Workshop on
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**Activity of Quartz in Pulverized Coal Fly Ash in Israel as Related
to Occupational Health Aspect**

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Abstract

Quartz (α -quartz), is the most common crystalline silica polymorph in nature and is the only polymorph found in significant concentrations in coal and coal ash. Since exposure to quartz is liable to cause lung diseases, it is very important to know its concentrations in coal ash and to evaluate its effects on the workers in contact with it. Inhalation is the most effective route of entry for airborne particles of coal ash; therefore the quartz content in the respirable fraction must be determined since only these quartz particles, when active, can induce respiratory diseases.

Similarly to what was found in other countries (e.g., the Netherlands), we found that the quartz concentration in the respirable fraction of the coal fly ash produced in Israel is considerably lower than in the whole ash. While X-ray diffraction is the most accurate way to measure quartz concentrations in mineral samples, this method cannot distinguish between coated and uncoated particles. Scanning electron microscopy, though less accurate, is able to differentiate between coated and uncoated particles. Our experiments show, similarly to those of other researchers, that practically all of the quartz particles in the respirable fraction are coated by amorphous aluminosilicate layers, this is based on results of SEM, analyses of 36 particles of Blend, an Indonesian fly ash and of 25 particles of BB Prime a South African fly, all of these were found to be coated. Coated quartz particles are not considered to have pneumoconiotic effects.

Nevertheless the Occupational Safety and Health Regulations in Israel still classify fly ash as silicotic dust due to the presence of quartz. This classification holds for any percent weight of quartz, even when it is below 1% in the respirable fraction of the fly ash. In view of the experimental results presented here and results published on this subject in the literature, and the present one, it is incorrect to classify fly ash as silicotic because of its quartz content, since it is proven to be below the accepted epidemiologic non-carcinogenic level, NOAEL (No Observed Adverse Effect Level). The results of recent studies, and the present one, strongly suggest that the inclusion of fly ash in the category of silicotic dust in health and safety regulations in Israel should be reconsidered.

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Table 1: Concentration of quartz in coal fly ash dust samples

Sample No.	Quartz Concentration (%)
Inhalable dust	
1	3.3
2	3.2
3	2.3
4	4.3
Respirable dust	
5	2.5
6	2.8
7	2.7
8	2.9
Bulk fly ash	
9	5.0

Table 2

Analyses of selected particles smaller than 10 μm ; the total of the elements analyzed is considered to be 100%. The sample number relates to the particles in Figure 5. Results are given in %.

Element/Sample	1	2	3	4
O	61.4	47.7	64.1	61.8
Na	4.7	1.6	1.1	1.9
Mg	0.6	1.3	0.2	1.1
Al	14.4	16.9	2.3	8.3
Si	15.6	25.3	28.4	21.5
K	0.8	1.9	0.4	1.4
Ca	0.5	0.7	0.1	0.6
Ti	0.1	0.4	0.4	0.4
Fe	1.8	4.2	3.0	3.0
Total	100	100	100	100

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Table 3

Analyses of selected particles between 20 and 40 μm ; the total of the elements analyzed is considered to be 100%. The sample number relates to the particle number in Figure 7. The results are given in %.

Element/Sample	1	2	3	4
O	64.40	60.68	64.35	58.79
Na	b.d.l.	4.07	2.80	3.94
Mg	b.d.l.	0.99	0.95	0.63
Al	0.30	10.80	3.59	9.96
Si	35.40	18.17	25.46	22.96
K	b.d.l.	0.71	0.72	1.63
Ca	b.d.l.	2.64	0.56	0.46
Ti	b.d.l.	0.30	0.20	0.21
Fe	b.d.l.	1.62	1.34	1.44
Total	100	100	100	100

b.d.l. – below detection limit