

# 沸石粉尘致肺纤维化作用实验研究

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**提 要** 本实验将 50mg 和 100mg 沸石粉尘分别进行大鼠气管内染尘。分别于染尘后 3、6、12、18 个月分批处死,进行肺脏及肺淋巴结的病理学形态观察及肺胶原含量测定。结果表明,沸石粉尘具有致肺纤维化作用,但较石英尘的致肺纤维化作用为弱。

**关键词** 沸石粉尘 动物实验 肺纤维化

沸石(Zeolite)是沸石族矿物的总称,是一种含水的铝硅酸盐矿物。中国的天然沸石已有十几种。大量开采利用的斜发沸石,由于它具有离子交换性、吸附分离性、催化性、稳定性、化学反应性、可逆的脱水性、电导性等,广泛应用于能源、石油化工、建筑、冶金、电子、宇宙空间技术、原子能等各个领域<sup>[1]</sup>。由于它的开采利用日益增多,接尘工人也在增加,吸入沸石粉尘对肺脏危害性资料却甚少。本文利用黑龙江省某矿生产的斜发沸石进行了动物实验研究,结果报告如下。

## 1 材料与方法

### 1.1 实验动物

采用 Wistar 健康大白鼠,体重 180~220g,雄雌各半。

### 1.2 染尘方法

大鼠经乙醚轻度麻醉,气管插管一次注入左右肺各 0.5ml 粉尘悬液。

### 1.3 沸石粉尘制备

沸石粉尘系某矿供应的斜发沸石经粉碎

研磨,分散度 $<5\mu$ 占 98%。沸石化学分析为  $\text{SiO}_2$  69.64%,  $\text{Al}_2\text{O}_3$  13.31%,  $\text{Fe}_2\text{O}_3$  0.72% 及少量其他氧化物。焦磷酸法测定游离  $\text{SiO}_2$  为 17.3%。粉尘经高压灭菌,无菌生理盐水配制成粉尘悬液,浓度为 50mg/ml 与 100mg/ml。

### 1.4 石英粉尘

石英粉尘系中国预防医学科学院劳动卫生与职业病研究所提供,游离  $\text{SiO}_2$  含量为 98% 以上,分散度为  $5\mu$  以下占 99.9%,配成 50mg/ml 浓度,应用方法同沸石粉尘悬液。

### 1.5 病理形态学检验

各期各组动物均称体重、肺湿重,记录眼观所见肺与淋巴结病变。取具有典型病变的一叶肺及淋巴结用 10% 甲醛固定,石蜡切片经 HE、Mallory、Foot 染色,光镜观察,按实验矽肺病理分级<sup>[2]</sup>。

### 1.6 肺胶原含量测定

病理取材之后全部肺脏乙醇固定,按比色方法测定胶原蛋白含量。

### 1.7 动物分组及处死时间,详见表 1。

表 1 动物分组及处死时间

组别	粉尘种类	剂量 (mg/只)	动物数 (只)	处死月份			
				3	6	12	18
A	沸石尘	50	40	10	10	10	10
B	沸石尘	100	40	10	10	10	10
C	石英尘	50	13	5	—	4	4
D	对照 Q 组	1ml 盐水	18	6	—	6	6

## 2 结果

### 2.1 病理形态学所见

A、B 组(沸石尘组)染尘后各期处死动物肺脏表面均见斑点状灰白色病灶, B 组较为密

集、触之不硬,一年后病灶硬度增加。肺门淋

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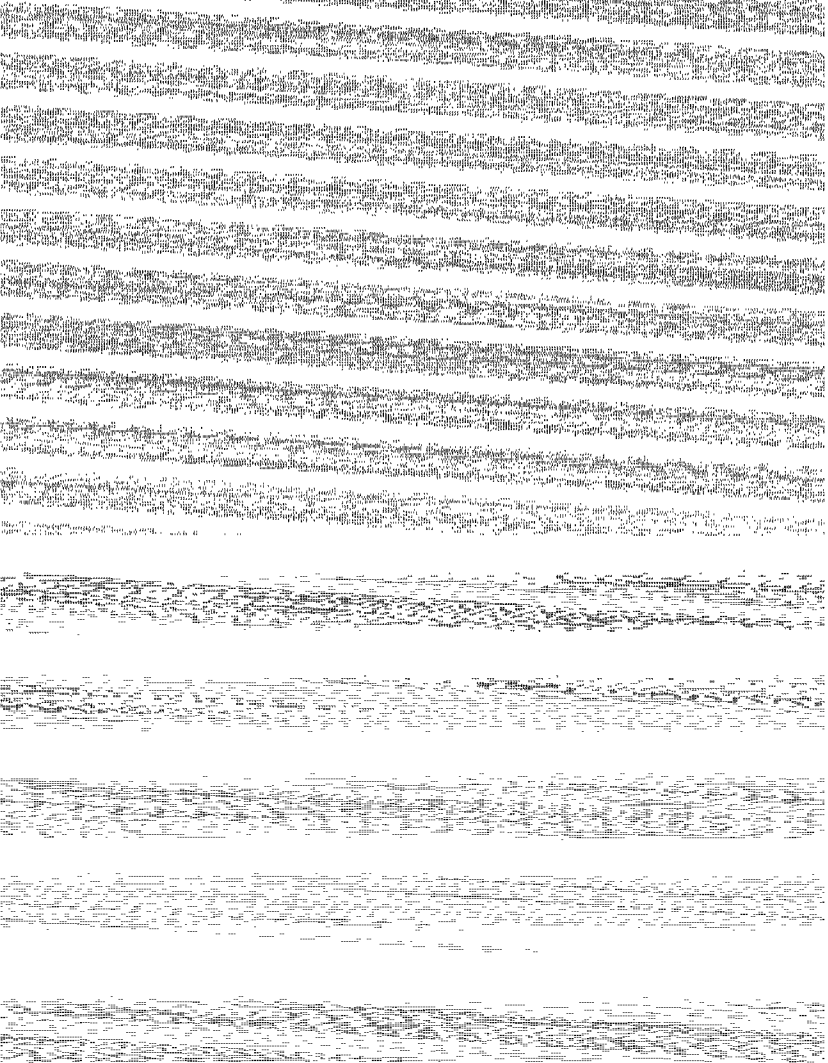


表2 全肺胶原含量 (mg)

组别	染尘种类及剂量 (mg/只)	月份			
		3	6	12	18
A	沸石 50	67.7	53.0	72.0	63.7
B	沸石 100	85.8	63.3	95.6	80.1
C	石英 50	257.6	—	245.3	453.2
D	盐水 1ml	38.0	—	60.0	60.7

表2显示肺胶原含量A、B组均较D组高。但远低于C组(注18个月时A、B含量低于3个月可能是取材问题)。

### 3 讨论与小结

沸石是不同种类、结构、成因、特征与性质沸石族矿物的总称。从SiO<sub>2</sub>含量与结晶习性(按结晶习性分为架状、片状、纤维状与未分类四种)本文实验用沸石粉尘含有游离SiO<sub>2</sub>17.3%。文献资料报道沸石矿游离SiO<sub>2</sub>含量多数在20%左右,故本文使用粉尘量有一定的代表性。从致纤维化作用方面看,它属于混合尘即具有硅酸盐尘肺的性质,多数硅酸盐粉尘致纤维化能力以其含有游离SiO<sub>2</sub>多寡致纤维

化作用不同。本文结果表明,沸石粉尘具有致肺纤维化作用,但与石英尘比较作用较弱。本实验结果与Kruglikov—GG报告一致<sup>[3]</sup>。实验期18个月纤维化程度仍然停留在Ⅱ级左右。同期石英尘组亦形成融合性纤维化病变,肺胶原含量测定亦看出此种区别,但这种尘肺病变仍有发展倾向。推论到接尘工人,可能以形成弥漫性纤维化为主的硅酸盐类尘肺,类似陶工尘肺、水泥尘肺。按文献提法<sup>[4]</sup>,肺内不形成典型矽结节,以混合尘结节与弥漫性纤维化为主的病变应称之为尘肺,故沸石尘引起的这种尘肺应称之为沸石尘肺。

### 4 参考文献

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## 尘肺并脱屑性间质性肺炎1例报告

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患者,男,52岁,于1989年10月6日入院。该患接尘6年,1968年经市尘肺诊断小组会诊确诊为Ⅱ期矽肺。胸闷、气短、四肢乏力20余年。一个月前除感上述症状加重外,出现咳嗽、发热,在市中医院诊断为心包积液,并给予抗炎、对症、利尿治疗,积液消失,后咳嗽,咯痰量较多、色黄、粘稠不易咯出,一旦咯出,开始为黑色痰块,而后为黄色粘稠痰。既往对磺胺类药物过敏。

体检: T36.8℃, P120次/分, R38次/分, BP12/9kPa。发育正常。口唇中度紫绀、咽赤、扁桃体Ⅰ度肿大。双肺语颤减弱,叩诊浊实音,可闻及干湿罗音,右肺后背部可闻及胸膜摩擦音。心脏叩诊心尖部略向左下扩大约1cm左右,听诊心律不齐,可闻及强弱不等的期前收缩。肝大肋下2cm,脾稍大。双下肢无浮肿。

辅助检查: 血常规 WBC10.9×10<sup>9</sup>/L, S0.78, L0.21。血甲胎蛋白阴性。BUN8mg/dl。痰培养有白色

念珠菌生长。ECG示窦性心动过速。胸片示心脏形态增大改变,心膈角减少,上腔静脉有增宽改变,双肺除尘肺改变外,纹理明显增强、模糊,右肺中野、左肺下野可见小片状阴影,边缘模糊。肺脏镜检在肺泡腔及细支气管腔可见较正常增大的肺泡细胞。

治疗经过:入院后给予强的松30毫克/日,两周后减量为15毫克/日,一个半月后停药,咳嗽、喘息明显减轻;咯痰量少,为白色泡沫痰;ECG恢复正常;痰培养未见细菌生长;血常规正常;胸片除尘肺改变外余无异常。住院两年半出院。随访两年无复发。

讨论 根据患者上述综合资料,确诊为Ⅱ期尘肺并脱屑性间质性肺炎。此病例较为少见,在治疗尘肺的同时,使用激素疗法较为理想,随访两年无复发,为本病的诊断及治疗探索了一条新途径。

(本文呈蒙秦志国同志指导,致谢。)

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## Abstracts of Original Articles

### Study on the Effect of Acute Heat Stress on the Lymphocytic DNA Damage of Pilot

Wu Tangchun .et al

The effect of acute heat stress on the lymphocytic DNA damage of pilot was studied with single cell gel electrophoresis assay. The study showed that acute heat stress could increase the occurrence rate of lymphocytic DNA damage of pilot and aggravate the damage degree of lymphocytic DNA. The analysis of the DNA damage of lymphocyte and the present diseases in pilots further showed that the occurrence rate of the DNA damage of lymphocyte in pilots with some diseases was higher than that of healthy pilot ( $P < 0.05$ ). These results suggested that DNA damage of lymphocytes might be considered as a supplementary index for the evaluation of pilot's health condition.

Key words: acute heat stress, DNA damage of lymphocyte, single cell gel electrophoresis assay

### Studies on the Function of Endocrine Glands of Welders

Cui Jinshan .et al

In order to study the effect of manganese on the pituitary, thyroid and adrenal cortex functions, we determined the levels of serum  $FT_3$ ,  $FT_4$ , TSH and cortisol (CS) in 51 welders exposed to manganese by RIA method. It was found that the levels of  $FT_3$ ,  $FT_4$ , TSH in serum of welders who were exposed to manganese at concentrations of  $0.13 \sim 0.33 \text{ mg/m}^3$  in the air of their workplaces were not significantly different from those in the control group. The results indicated that the excretive functions of pituitary and thyroid glands were impaired by the manganese exposure. The levels of serum CS in welders who were exposed to manganese for more than 10 years were markedly lower than those in the control group and the differences were statistically significant ( $P < 0.05$  and  $P < 0.01$  re-

spectively). The study indicated that the excretive function of adrenal cortex of these welders was impaired to certain extent. We recommended that serum cortisol could be used as a biological marker to examine the early effect of manganese on the function of adrenal cortex in welders.

Key words: welder, free triiodothyronine ( $FT_3$ ), free tetraiodothyronine ( $FT_4$ ), cortisone, TSH

### Epidemiological Survey of Malignant Tumor Among Workers in petro-chemical Plant

Wang Jinghe

A retrospective cohort study of cancer mortality at thirteen oil refineries in Jinzhou, Fushun, Lanzhou, Beijing, Dahan, Jinxi, Nianjing, Shanghai, Daqing and Maoming was conducted. 51 889 employees were studied, with 1 717 failed to follow-up (3.31%) in the survey. The results showed that the SMR of lung cancer in employees of shale oil refineries was remarkably high, with a dose-response relationship between SMR of lung cancer and exposure level. The OR value of lung cancer from 1977 to 1988 in heavily exposed employees of the coal-synthetic oil refineries was 9.25 by adjusting other environmental confusion effects with logistic regression analysis. OR for all-cancer mortality was high in employees of natural oil refineries, which showed annual increasing trend with the period of observation. SMR of stomach and liver cancer were 1.43 and 1.51 respectively with statistical significance.

Key words: petro-chemical plant, malignant tumor, cohort study

### Experimental Study on the Fibrotic Effect of Zeolite Dusts in Lungs

Ning Binlian, et al

50 mg and 100 mg zeolite dusts were injected

Study on the effect of acute heat stress on the lymphocytic DNA damage of pilot

Wu Tangchun, et al ..... (129)

Studies on the function of endocrine glands of welders

Cui Jinshan, et al ..... (132)

Epidemiological survey of malignant tumor among workers in petro-chemical plant

Wang Jinghe ..... (134)

Experimental study on the fibrotic effect of zeolite dusts in lungs

Ning Binlian, et al ..... (141)

Kinetic study of rerum SOD, Cp and IgG changes in tetrandrine and hydroxylpiperazine phosphate united treating silicosis

Chen Li, et al ..... (144)

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intracheally to 2 groups of wistar rats respectively.

Parts of the animals were killed at 3, 6, 12 and 18 months later for pathomorphological examination and for the measurement of collagen in lungs and in their drainage lymph nodes. The results showed that the zeolite dusts did have fibrotic effects on lung tissues but it was weaker than the quartz group.

Key words: zeolite dust, experimental animals, lung fibrotic

## **Kinetic Study of Rerum SOD, Cp, and IgG Changes in Tetrandrine and Hydroxylpiperazine Phosphate United Treating Silicosis**

### **Chen Li. et al**

The serum SOD was significantly lower at each course after treating with tetrandrine and hydroxylpiperazine phosphate together than before in treatment group. No such changes, however, were found in control group. Although no significant changes were detected for Cp and IgG at each course of treatment in two groups, there was a decreasing tendency for serum Cp and IgG at 3rd and 6th course of treatment in treating group after adjusting by treatment/control ratio (T/C value).

Key words: silicosis treatment, SOD, Cp, IgG