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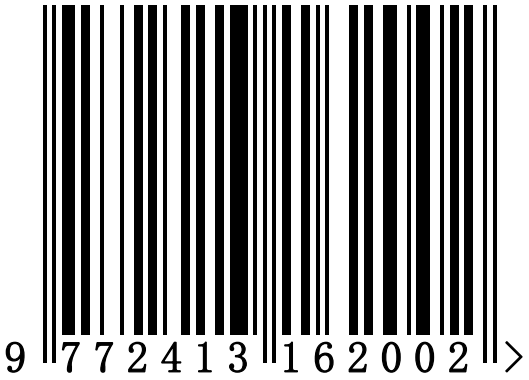

Article 1. Epidemiology: The Airborne Heavy Metal Pollution and Microbes/病理传播学：环境空气重金属与微生物

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1. Review of Atmospheric Heave Metal Pollution and Microbes

1.The Heavy Metal Pollution

The pollution sources of heavy metal are mainly through three pathways: the aerosol, diet and water environment[1]. This article focus on the atmospheric pathway of heavy metal pollution with the representative pollutants of lead and mercury.

1.1.The Pathology of Heavy Metal Toxicity

The toxic heavy metal associates with the pathology of all organs, with particularly attention to the kidney as the most sensitive organ to the toxicity of heavy metal. There are some identified mechanism of pathology in kidney caused by the toxic heavy metal pollution[2]:

1.1.1.Alteration of permeability and transport function in cellular membrane

Heavy metal inactivates the membrane lipid, leading to the alteration of permeability and transport function in cellular membrane.

1.1.2.Impact on the enzyme and nuclein

In cell, the heavy metal react with organic molecules or the functional group of enzyme, which results in the exchange of essential metal ions or inactivation of enzymes. The heavy metal ions also combine the non-enzymatic protein and nucleic acid, inactivating the biological organs.

1.1.3.Distorting the immunological system

The heavy metals, as half antigens, react with proteins into complex antigens, distorting the immunological system of biological organs.

1.1.4.Secondary pathology

The secondary pathological characteristics associating the heavy metals mainly include methemoglobinemia, hematolysis, shock, anoxia and electrolyte disturbances.

1.2.Pathology of Lead

The main perniciousness of lead is the chronic interstitial nephritis, which has been testified physiologically by the evidence of excessive lead in the inclusion body of renal epithelial cell using animal test. The pathological characteristics of lead toxicity usually include Fanconi-de Toni syndrome, benign glycosuria, amino-aciduria, albuminuria, cylindruria, urine lead ascending and hypertension etc. Approximately

50% of patients of toxic lead are associated with pathological characteristics of hyperuricemia, arthrolithiasis, and osteosclerosis in bone X-ray (typical increase of texture in the end of long bone)[2].

1.3.Pathology of Mercury

The physiological mechanism caused by mercury is that the mercury combines with sulfur hydrogen group of mitochondrial membrane protein, resulting in the decomposition and destruction of mitochondria and nuclei. The compounds of plasma mercury tightly combines with proteins, allowing only 1% of glomerulus to permeate. The accumulation of mercury intensively occurs in the proximal tubule of kidney, manifesting the formation of granule in epithelial cells or vacuolar degeneration with serious pathology as focal tubular rupture. The acute characteristics of pathology include the renal failure, urine dipstick for protein, cast epithelial, the increase of red-blood-cells, diabetes, acidaminuria, and mercury urine, as well as chronic characteristics of nephrosis syndrome[2].

2.The Airborne Microbial Pollution

Acute respiratory infection is divided into anemofrigid cold and anemopyretic cold by Traditional Chinese Medicine (TCM) [3]. The population density and microbial diversity of aerosol samples in oral cavity were compared between the heathy one and patients by Chen et al.,(2005)[3]. However, the patients are diagnosed as anemofrigid cold and anemopyretic cold by TCM separately, which are correspondingly compared independently as well. The background microbial ecosystem are sampled and analyzed in this research for the assessment of meteorological effects on the microbial communities. The conclusion of this research supports the theory of ‘alteration of eco-balance’ in microbial ecosystem revealed by the increase of microbial density and decrease of microbial diversity, which is considered as the causal factor of acute respiratory infection. However, the specific pathogenesis of each microbial species has not been characterized in this research, and the classification of microbial species is based on the morphological characters only. Particularly, the establishment of pathogens is performed as a microbial community rather than a population of single species in this research, which further supports the improvement of biological control pointed by another article of this journal [4].

2. Examination of Environmental Toxicity

This article designed the methods of examination of environmental toxicity in heavy metal pollution adhering to aerosol:

Step 1: two parallel samples of rats, as the receptors of heavy metal pollution, are exposed to two kinds of environmental conditions respectively for the same duration: one is adjacent to the transportation road where the main pollution source of heavy metal is diesel; the other is the factory in which the pollution source of heavy metal is the industrial emission. The height of rat samples should be located at the level of people’s breath zone. The rat’s total urine during two hours after exposure experiment

is collected for analysis.

Step 2: The cumulative exposure dose of heavy metal pollution adhering to aerosol are monitored in both sites, and the test of mean heavy metal concentration in the urine after exposure experiment are correspondingly conducted for the analysis of correlation. The standards of monitoring the heavy metal pollution include: GB/T16157, HJ/T 373, and HJ/T48...etc.

Step 3. The ratio of mean heavy metal concentration in urine to the cumulative exposure dose is calculated, for the assessment of the difference in environmental toxicity between two different emission sources, which emit aerosols with different morphology. The mean heavy metal concentration in the urine after exposure experiment is compared with relevant standards of limit value to reveal the degree of health (The higher concentration, the more environmental toxicity).

Step 4. The total content of heavy metal in the urine after exposure experiment is also counted, which is divided by the cumulative exposure dose so that another ratio is worked out for the assessment of environmental toxicity (The higher ratio, the more environmental toxicity).

Step5. 8-hours exposure duration, 24-hours exposure duration and long-term exposure duration are chosen for the investigation of environmental toxicity in heavy metal at different durations.

Step 6. After multiple test, the mean ratio becomes a stable criterion to examine the effects of the environmental toxicity in heavy metal pollution.

Step 7. The mean heavy metal concentration in urine is also tested in people who are working in both sites as ‘clinical trial’, and the correlation between the cumulative exposure dose and mean heavy metal concentration in urine is analyzed. The mean heavy metal concentration in the urine after exposure experiment is compared with relevant standards of limit value to reveal the degree of health.

Step 8. The fine airborne particles collected from two different pollution sources are scanned by transmission electron microscopy, to investigate the morphology difference of airborne particles between two pollution sources. Then the effects of airborne particle morphology on the environmental toxicity of heavy metals is further assessed. The measurement method of fine particulate matters by using electron microscopy is designed by the articles [5][6].

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