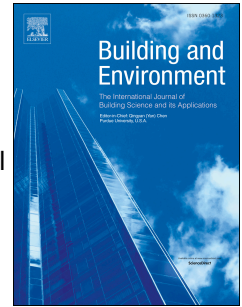


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Exposure assessment of children to particulate matter and gaseous species in school environments of Pune, India

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1 **Exposure assessment of children to particulate matter and gaseous species in school environments**
2 **of Pune, India**

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5
6 **Abstract**

7 Indoor air quality of schools is a subject of great significance for the assessment of the effects of children
8 exposure to air pollution. In order to characterize the indoor air quality, coarse and fine particulate matter
9 (PM) levels, concentration of gaseous pollutants (CO₂, SO₂, NO₂, O₃) and major anions, elemental
10 concentration, morphology and risk assessment were evaluated from the samples collected in different
11 naturally ventilated schools in Pune, India. Mass concentration of both coarse and fine PM exceeded 5
12 times WHO standards, which clearly indicates the insufficient fresh air in school buildings of Pune in
13 terms of PM. The average concentration of gaseous pollutants were within prescribed limits of NAAQS
14 except CO₂ which was higher in concentration than the limit set for confined spaces, thus showing the
15 inadequate air exchange rates in the studied schools. The Ca showed significant dominance among the
16 analyzed metals in both fraction of PM followed by Mg, Na and K. Cd showed higher bioavailability
17 index among the carcinogenic metals leading to health hazards to exposed children. The cancer risk for
18 Cr, Cd, Ni, and Pb in both sized PM were much higher than the acceptable limits of USEPA. Average
19 anionic concentration followed the similar pattern for both sized fraction of PM and the trend was NO₃⁻>
20 SO₄²⁻>Cl⁻>F⁻. The morphological analysis revealed the presence of various shaped particles composed of
21 various constituents of Si, C and Ca. Questionnaire survey and personnel interview showed the
22 prevalence of cold, running nose, cough, fever and eye irritation among the studied school children
23 exposed to the PM and gaseous species. The health problems such as cold, cough and fever were found to
24 be the main cause of absenteeism of children.

25
26 **Keywords:** Indoor air quality, Schools, Bioavailability, Cancer risk, Morphology

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