PM2.5 is more damaging to the biomolecules than PM10 because of more mobilized transition metals

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The mobilizable amount of transition metals is a fraction of the total amount of the metal from urban particulate matter. Although the fraction is small, some metals (Fe, Cu) are the major participants in a reaction that generates reactive oxygen species (ROS), which can damage various biomolecules. Damaging effects of the metals can be measured by the single strand breakage (SSB) of ϕX174 RFI DNA or the carbonyl formation of protein. We hypothesized that the mobilizable fraction and thus the damaging effect of the metals be affected by the size of the dust particle. In another study, we have shown that more metals are mobilized by PM2.5 than by PM10 in general. However, it needs to show that more mobilized metals are more damaging to DNA and proteins since a metal can agonize or antagonize the effect of the other metal. PM2.5 and PM10 collected from a metropolitan area were employed. DNA SSB of >20% for PM2.5 and >15% for PM10 was observed in the presence of chelator (EDTA or citrate)/reductant (ascorbate), compared to the control (<3%) only with the chelator. The carbonyl formation by both PMs was very similar in the presence of the chelator, regardless of the kind of proteins. Compared to the control in the absence of chelator/reductant, 3.3 times and 4.9 times more carbonyl formation for PM2.5 and PM10, respectively, was obtained with BSA in the presence of chelator/reductant, showing that PM10 induced 33% more damage than PM2.5. However, 4.8 times and 1.9 times more carbonyl formation for PM2.5 and PM10, respectively, was observed with lysozyme in the presence of chelator/reductant, showing that PM2.5 induced 150% more damage than PM10. Although different proteins showed different sensitivities toward ROS, all these results indicate that the degrees of the oxidation of, or damage to, the biomolecules by the mobilized metals were higher with PM2.5 than with PM10. Therefore, it is expected that more metals mobilized from PM2.5 than from PM10, more damage to the biomolecules by PM2.5 than by PM10. We suggest that when the

toxicity of the dust particle is considered, the particle size as well as the mobilizable fraction of the metal should be considered in place of the total amount. This research was supported by a grant from the Ministry of Environment G-7 project, Korea.