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Paper/Poster-Abstract Form

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Title:
The oxidative potential of nanoparticles exhausted from automobiles

Abstract: (min. 300 – max. 500 words)

The abstracts for papers and posters must contain unpublished information on your research subject: background, investigation methods, results and conclusions. Graphs and references are very welcome. Acronyms should be avoided. Abstracts with < 300 words can not be considered. General information on products which are already commercially available can not be accepted as presentations for the conference but are very welcome at the exhibition of particle filter systems and nanoparticle measurement instruments.

According to studies of a toxicity for nanomaterials such as titanium oxide, there is a report that the smaller particles have a stronger toxicity under a same weight condition, especially those toxicity is correlated to surface area of particles.

On the other hand,the oxidative potential has been measured by institutes in EU and USA as an important chemical properties of particles.

Therefore, we investigated the correlation between oxidative potential of PM (particulate matter) which were exhausted from vehicles and PM weight, surface area, and particle number. The oxidative potential of PM separated into some particle diameters was measured by means of the DTT (dithiothreitol) assay. The surface area was calculated from the particle size distribution by EEPS (engine exhaust particle sizer).

At first, we found that there was good correlation between oxidative potential of PM exhausted from diesel and petrol and PM weight, and total surface area of particles as well. However, there was no correlation with particle numbers.

Secondary, it was estimated that a contribution of sub-23nm particle to oxidative potential of PM was 10% or less in the result of evaluation for the surface area of whole and below 23nm particles.

On the other hand, generally, it is said that smaller particles tend to be coagulated each other. Therefore, there may be a possibility that nanoparticles exhausted from vehicles coagulate as well.

Then, it was investigated the coagulation of nanoparticles exhausted from vehicles in saline solution which was under a condition of neutral pH. Actually, it was confirmed that the exhausted nanoparticles coagulated from 100 nm or less to 3 micrometers in the solution.

In conclusion, though it was a limited condition, the findings were obtained as follows.

1. The oxidative potential of particulate matters is able to be explained weight and surface area of particles but no relation to particle numbers.
2. The oxidative potential of sub-23nm particles against for total is 10% or less.
3. Exhausted nanoparticles have the possibility of being easy to coagulate in solution.

Short CV:

I took a doctor's degree in Pharmacy at Kanazawa University, Japan. Since joining Toyota Motor Corporation in 2007, I have worked on chemical analysis of materials emitted from automobile.

Assistant manager, Advanced Engine Technology Development Dvi. at Higashi-fuji Technical Center of Toyota.

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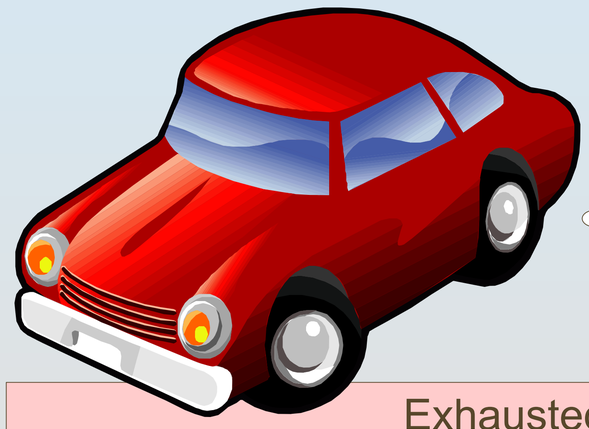
The Oxidative Potential of Nanoparticles Exhausted from Automobiles

OKAMURA Kazumasa, TOYOTA Motor Corporation

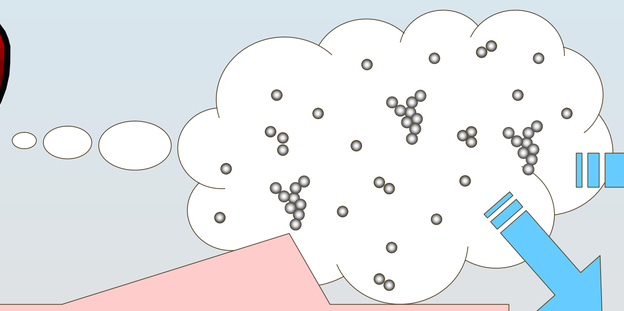
TOYOTA Environmental Action

- Promote the development of ultra-low emissions technologies and introduce the best-performing low-emissions vehicles according to conditions in each country
- Research the influence of exhaust emissions to atmospheric environment in a scientific manner

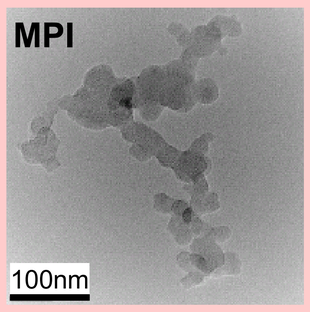
What is PM characteristic relevant to the oxidative potential ?

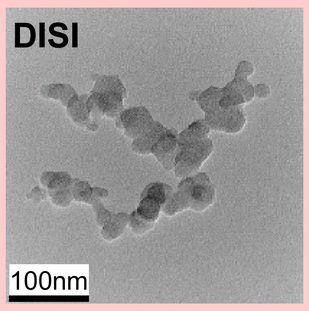


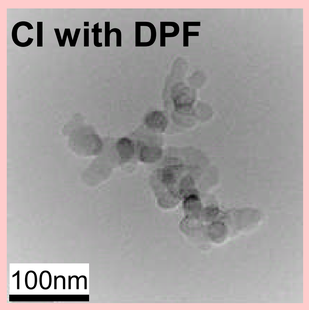
Particulate Matter(PM)



Exhausted Nanoparticles (TEM)





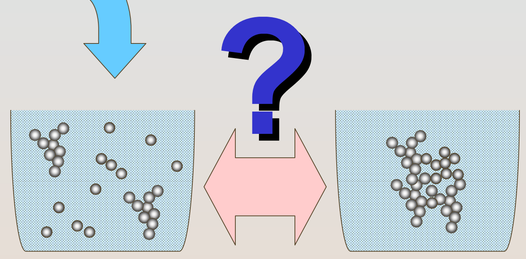


Characteristic

- **Mass**
- **Surface**
- **Number**

? ①Oxidative potential

an important chemical property of PM

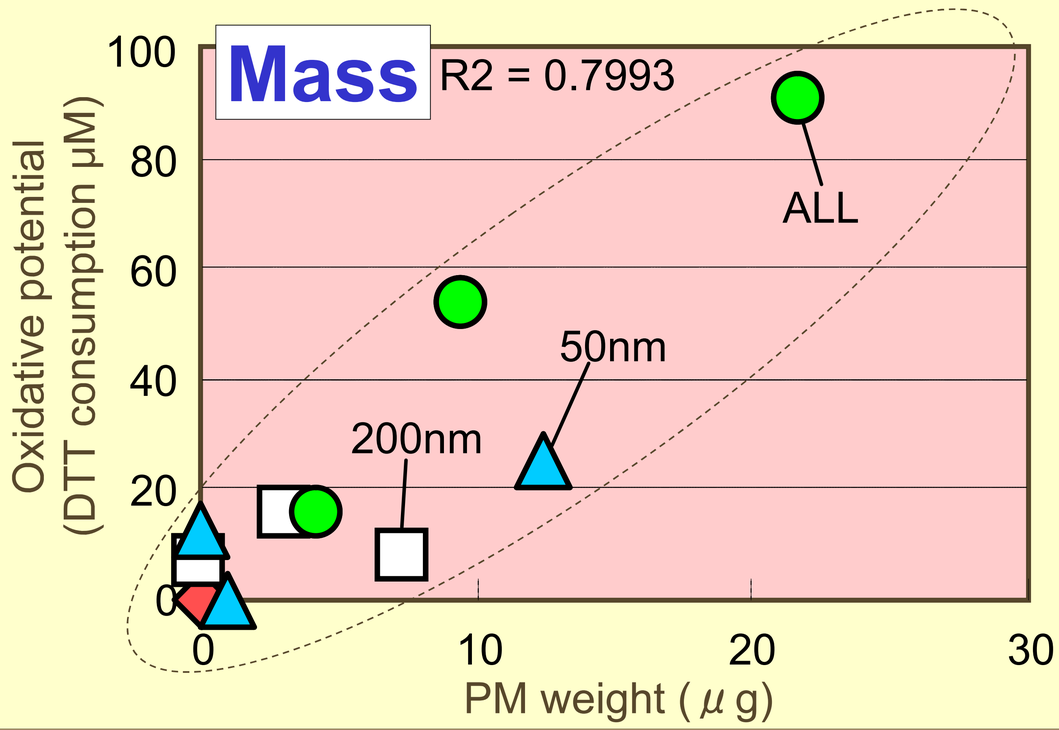


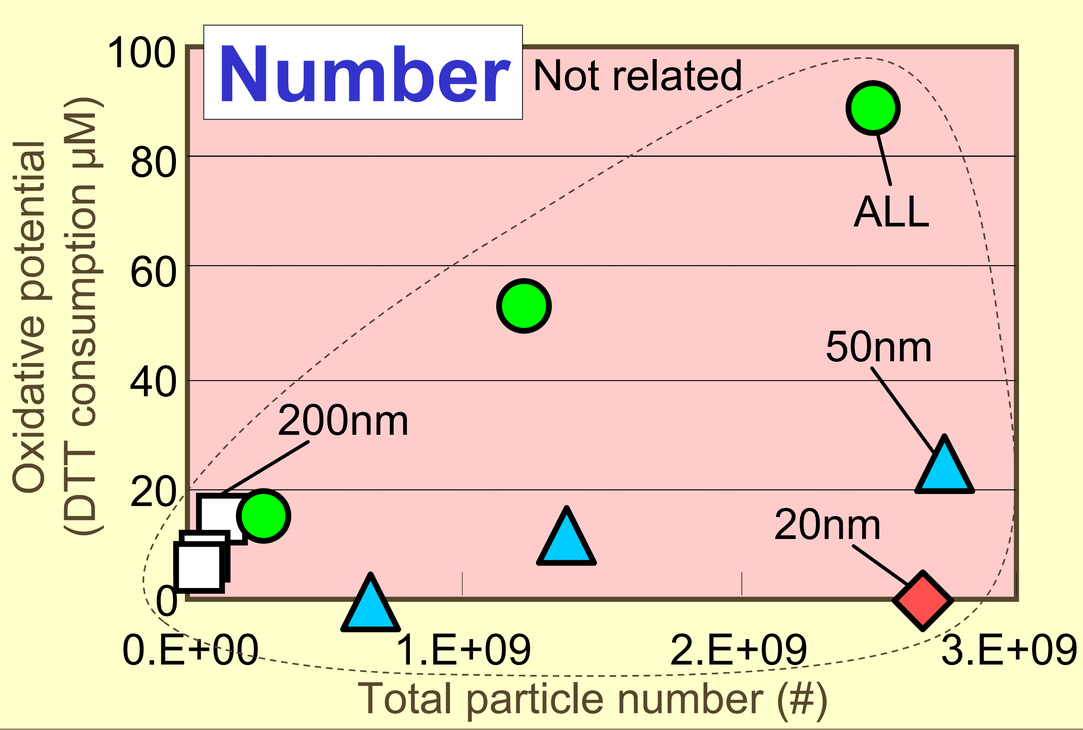
? ②Dispersibility

in aqueous solution

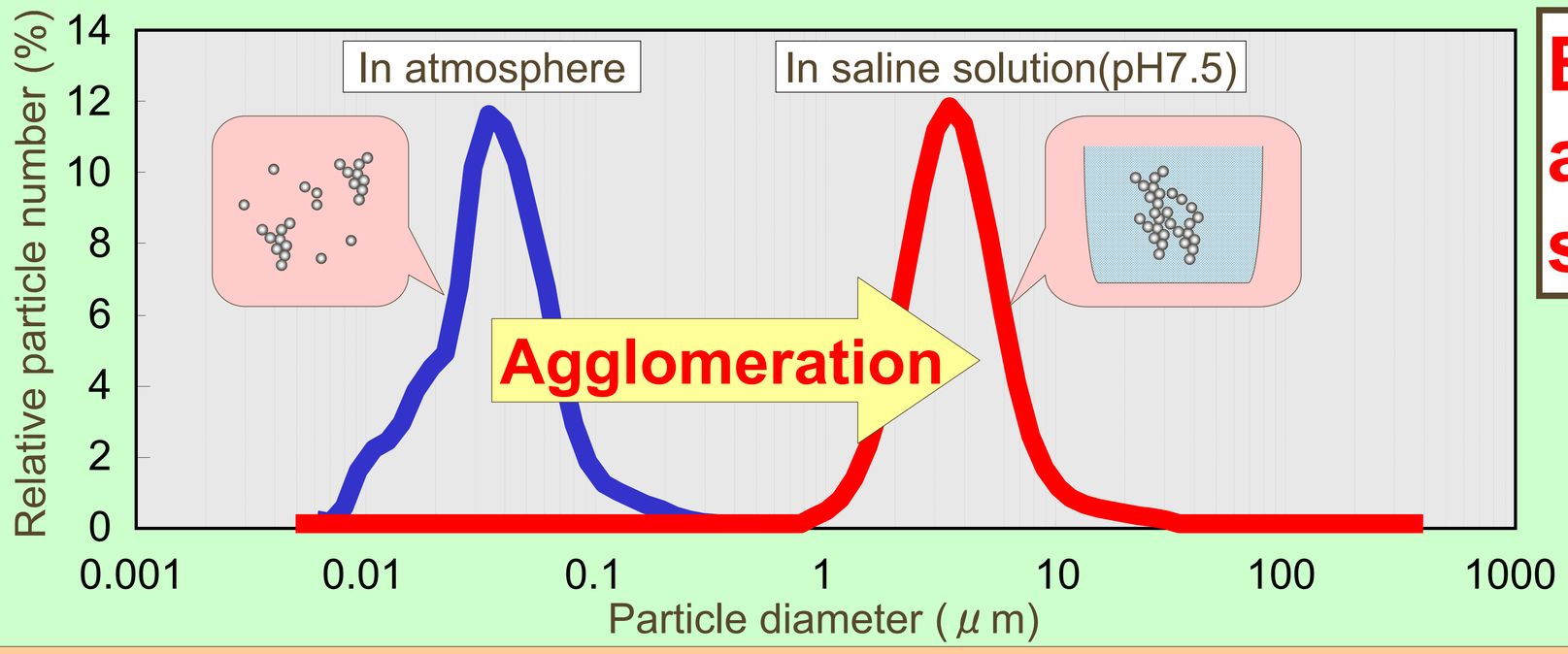
① Oxidative Potential vs Mass, Surface or Number of PM

PM mass (≒ surface area) is correlated with the oxidative potential





② Dispersibility of PM in aqueous solution



Exhausted nanoparticles are agglomerated in saline solutions

Experimental conditions

- PM: Diesel engine out
- PM classification: DMA
- Oxidative potential: DTT assay
- Dispersibility: laser diffraction/scattering