

## An investigation into seasonal and regional aerosol characteristics in East Asia using model-predicted and remotely-sensed aerosol properties

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The spatio-temporal and seasonal distributions of EOS/Terra MODIS-derived aerosol optical depth (AOD) over East Asia were analyzed in conjunction with US EPA Models-3/CMAQ v4.3 modeling. Two MODIS AOD products ( $\tau_{\text{MODIS}}$ :  $\tau_{\text{M-BAER}}$  and  $\tau_{\text{NASA}}$ ) retrieved through a modified Bremen Aerosol Retrieval (M-BAER) algorithm [1,2] and NASA collection 5 (C005) algorithm [3] were compared with the AOD ( $\tau_{\text{CMAQ}}$ ) that was calculated from the CMAQ [4] model simulations. In general, the CMAQ-predicted AOD values captured the spatial and temporal variations of the two MODIS AOD products over East Asia reasonable well. Since MODIS AOD can not provide information on the aerosol chemical composition in the atmosphere, different aerosol formation characteristics in different regions and different seasons in East Asia cannot be described by MODIS AOD itself. Therefore, the seasonally and regionally varying aerosol formation and distribution characteristics were investigated by the CMAQ v4.3 model simulation. The contribution of each particulate chemical species to AOD through the M-BAER and NASA algorithms and the CMAQ-predicted AOD showed strong spatial, temporal and seasonal variations. In this study, we showed that the importance of  $\text{NH}_4\text{NO}_3$  in estimating AOD should not be ignored, particularly in studies of the East Asia air quality. In addition, the accuracy of two MODIS AOD values was evaluated by a comparison with the AOD from the AERONET sites [5].

[1] Lee *et al.* (2006) *Int. J. Rem. Sens.* **27** (14), 2813-2830.  
[2] Lee *et al.* (2007) *Atmos. Environ.* **41**, 3959-3973. [3] Levy *et al.* (2007) *J. Geophys. Res.* **112**, D13211. [4] Byun & Schere (2006) *Appl. Mecha. Rev.* **59**(2), 51-77. [5] Holben *et al.* (1998) *Rem. Sens. Environ.* **66**, 1-16.

## Manganese solid produced during arsenite oxidation by permanganate

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Solids formed during the reduction of permanganate ( $\text{MnO}_4^-$ ) have recently been paid much attention because it is widely used for both *in situ* and *ex situ* oxidative treatments of various contaminants. Permanganate also effectively oxidizes As(III) to As(V), both of which are the dominant As species in the environment. Because the former is generally more toxic and mobile than the latter, oxidizing As(III) is recommended for the treatment processes of As-contaminated water. The stoichiometric coefficient of As(III) to  $\text{MnO}_4^-$  has been generally assumed to be 1.5 based on the assumption of  $\text{Mn(IV)O}_2(\text{s})$  formation as a reaction product. Previous studies demonstrated that the oxidation state of structural Mn in Mn-(hydr)oxides should be a crucial constraint in heterogeneous oxidations and sorption reactions of the solids. In addition, Mn-(hydr)oxides usually contain varying oxidation states (+II, +III, or +IV) as well as mixed valences in the environment. These facts stimulate the characterization of Mn-solid phase formed from As(III) oxidation by  $\text{MnO}_4^-$ , which can provide information about not only the stoichiometric ratio of the reaction but also the surface-catalyzed electron transfer between As(III) and the solid.

In this study, the reaction stoichiometry was determined with varying doses of As(III) (0.10 or 0.30 mM) and  $\text{MnO}_4^-$  (0.35 or 0.50 mM) at pH ~ 7 in 50 mM  $\text{NaNO}_3$ . Mn-solid product was obtained from the reaction of 2.2 mM As(III) with 1.0 mM  $\text{MnO}_4^-$  at pH 6.9 in 50 mM  $\text{NaNO}_3$  after 1 min. The stoichiometric ratio of reacted As(III) to  $\text{MnO}_4^-$  was  $2.0 \pm 0.1$ , indicating the average oxidation state of Mn in the solid product being +III. This result was commensurated with the splitting interval of Mn3s peaks determined as 5.4 by X-ray Photoelectron Spectroscopy (XPS). The ratio of structural Mn(IV):Mn(III):Mn(II) was quantified as 19:63:18 based on  $\text{Mn}2p_{3/2}$  XPS photoelectron lines. Combined data obtained from the analyses of ICP-AES, SEM-EDS, and FT-IR showed that the solid product also contained ca. 10 wt% As(V).