

## ***Interactive comment on “Average molecular weight of surfactants in aerosols” by M. T. Latif and P. Brimblecombe***

**M. T. Latif and P. Brimblecombe**

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Answer to the comments

Anonymous Referee 1

Major comment

The measurement of molecular weight was based on nominal molecular weight of aerosols extract. It was to determine the possible molecular weight of surfactants in the atmosphere.

We will take into account the concentration of  $\text{NH}_4^+$  for the calculation of surrogate acidity.

Specific comment

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## Comment 1:

Agree to make rewrite the introduction section.

## Comment 2

Agree to delete the phrase 8220;it is clear that they are associated with water soluble oxygenated and macromolecular polar organic substances.8221;

## Comment 3

Agree to quote the paper by Graber and Rudich (Atm. Chem and Phys. 6, 729-753, 2006) related complex organic components and the humic substances in soil and sediments.

## Comment 4

Section 2.1. Agree to put a table summarizing the origin and type of the samples

## Comment 5

Section 2.6. 8220;Brown colourant8221; refers to the colour of aerosol extracts and its possible sources which have similarity with the colour of humic substances. The molecular size of 10K and 30K Da were used because they can be separated by using 5K Da molecular size filter. We agree to explain about the 8220;brown colourant8221; in the introduction.

## Comment 6

Section 2.9. Soot exposure to ozone analysis aimed to look at similarity and possibility of combustion product e.g. soot can generate surfactants in the atmosphere after exposed to strong oxidants e.g. ozone. We agree to specify the source of the soot and humic acid materials in the manuscript.

## Comment 7

Samples Figure 1a and Figure 1 b refer to an aerosol sample collected at UEA Norwich

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Comment

(on 3rd of December 2003). The date will be stated at the graph. The sample would like to show the examples of surface tension trend of aerosols samples from fine and coarse mode which indicated the same trends for the whole samples. The minimum amount of DOC of the aerosols samples was undetected for both coarse and fine mode aerosols.

## Comment 8

Agree with reviewer to add  $\text{NH}_4^+$  for the determination of surrogate acidity. Surfactants was found to have correlation with anthropogenic activities and can also originate from secondary sources.

## Comment 9

Agree with reviewer DOC found in aerosols does not hold for background aerosol, in which both surfactants and DOC can be influenced by natural sources and ageing. Nevertheless in this research the concentration of DOC found to have significant effect to the surfactants concentration after 100 nmol  $\text{m}^{-3}$ . Will includes this argument in the results and discussion.

## Comment 10

Section 3.5.2. Agree to reorganised this section.

## Comment 11

Agree to replace 8220;MBAS8221; with 8220;EVAS8221;

## Anonymous Referee 2

## Comment 1

Agree to explain more regarding the characteristics of HULIS in the introduction.

## Comment 2

The surface tension analyses were based on the changing of the surface tension of the

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droplet generated from aerosols extract. This is an early study to indicate the change of surface tension with time of a droplet generated from coarse and fine mode aerosols. Agree to correlate this phenomenon to the condition of cloud droplet.

Minor comment

Agree with all minor comment suggested by the referee.

Anonymous Referee 3

Specific comments

Comment 1:

Agree with the reviewer and already reword to the abstract. Emphasize on the determination of molecular weight of surfactants in the abstract.

Comment 2:

There are still no evidence related to the significant amount of surfactants in the previous literature

Comment 3

Agree to reword the section by describing that HULIS is a fraction of the surface active materials of macromolecules compound with high molecular weight followed by the estimation of its molecular weight and concentration.

Comment 4

Explanation changed to how HULIS get its name based on the characteristic of humic substances

Comment 5

EVAS is a new method introduced to determine surfactants using different dye than methylene blue. It was found that EVAS method more interfere by inorganic substances

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in the solution.

#### Comment 6

Add more information regarding to soot composition and formation. Soot and humic acid were exposed to ozone in dry condition. After exposure the extracts of soot were prepared by using milli Q water, shaken and filter using 0.2 um 47 mm acetate filter paper and dilute the solution to 100 mL by using volumetric flask.

#### Comment 7

The samples for this experiment were collected from several sampling stations in Malaysia and UEA, United Kingdom. The samples were differentiated between samples at UEA (collected at difference seasons) as the main sampling station and the combination of all sampling station in Malaysia. This combination represent all aerosols extracts.

#### Comment 8

This measurement actually to differentiate between the changes of surface tension of the droplet generated from fine mode aerosols extract and coarse mode aerosols extract. All samples collected at UEA were measured their surface tension trend and showed the same results. This experiment believes to be time dependant until the system reach equilibrium or the surfactants do not affect the surface tension of the droplet. The plot of the measurement of the surface tension as function of surfactants concentration cannot be done because the surface tension of the aerosols extracts was not determined. This measurement just wanted to look the effect of the surfactants to the surface tension of the droplet.

#### Comment 9

Agree to introduce abbreviations (n, r, p) of linear regression. Acidic pollutants mention relate to the concentration of nitrate and sulphate usually generated by combustion processes. This will be included in the manuscript

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Comment 10

Agree to move section 3.3 before 3.1

Comment 11

The bar represents the standard deviation. The coarse mode concentration was quite low to separate into different molecular weight.

Comment 12

There is no particular reason to choose 400 nm as a wavelength. It just look at the intensity of the color of aerosol extracts.

Comment 13

We did not measure the UV spectra of the sources before and after the ozone exposure. We will consider this experiment on our next analysis to compare with the UV spectra of aerosol extracts.

Technical error

Agree with all the comments

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Interactive comment on Atmos. Chem. Phys. Discuss., 7, 13805, 2007.

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