

Interactive comment on “Influence of Rain on the Abundance and Size Distribution of Bioaerosols” by Chathurika M. Rathnayake et al.

Anonymous Referee #2

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General Remarks:

In this study, the abundance of different bioaerosols (pollens, fungal spores and bacteria) present in both fine and coarse fraction of atmospheric aerosols is measured using chemical tracer method. The changes in the ambient concentration of bioaerosols and their relative abundance in different size fraction in response to variation in environmental conditions, especially rainfall were also assessed. Additionally the authors have also characterized the chemical profiles of different regionally abundant pollens and have estimated the pollen and fungal spore contribution to PM mass by using CMB modeling.

On general reading, the findings reported in the paper are quite interesting, however they are inconsistent in certain places. In this study since the authors quantify the

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atmospheric abundance of different bioaerosols in only two broad size ranges (PM_{2.5} and PM_{2.5-10}), I feel the use of term “size distribution” is inappropriate and misleading. In addition to chemical tracer analysis the authors have not given any other supporting results to further strengthen their finding of presence of smaller fraction of bioaerosols during the rain events.

Specific Remarks:

Fig.1, shows the microscopic images of pollen which are $>20 \mu\text{m}$. How is it relevant to show these images here as the authors are not measuring PM $> 10 \mu\text{m}$. Also these are not the images of pollens being measured from ambient atmosphere during any of the mentioned measurement periods. Instead of these images it make more sense to show images of ruptured pollens either collected from ambient atmosphere or from laboratory studies, which could further support their argument of presence of pollen fragments $< 2.5 \mu\text{m}$ in size.

In Fig. 2, PM_{2.5-10} mass on April 17 and 18 appears to be zero. But there is glucose detected in this size fraction (Fig. 2c). How is this possible?

Page 5, L 27: Correct as Biomarkers.

Page 7, L 25: “Rain also affected the distribution of particles between the fine and coarse modes, with $48\pm 11\%$ of PM₁₀ was less than $2.5 \mu\text{m}$ on rainy days compared to $80\pm 13\%$ on dry days”. This sentence is confusing. Is the author mentioning about %contribution of PM_{2.5} in PM₁₀ during wet and dry days?

Page 8, L 23: “passive release of larger pollen particles ranging $2.5\text{--}10 \mu\text{m}$ during others”. What could be these larger pollen particles released passively during dry days? The microscopic images shows only pollens $> 20 \mu\text{m}$.

Page 9, L 1: From the ratio of glucose and sucrose the authors have related the pollens present on May 9 to that of red oak. Is there any other evidence to support this? The authors have mentioned in section 3.1 that the carbohydrate distribution in pollens are

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likely to differ with change in environmental factors. Hence it is difficult to relate the pollens to any particular type only based on carbohydrate ratio. Also the authors have not reported any such match in carbohydrate ratios on any other days or in coarse mode PM fraction.

Page 9, L 16: “shift in glucose size distribution to 34% in the fine mode”. It is not actually the size distribution, instead the relative contribution of glucose in fine fraction increases.

Page 9, L 23-24: “Daily concentrations of coarse mode concentrations of two fungal spore tracers—fungal sugar mannitol and the fungal cell wall component glucan—were significantly correlated with daily average temperature ($r_s > 0.4$, $p < 0.05$)”. This statement appears to be significant only for mannitol and not glucan. In L 27, The authors have reported an increase in fungal spore tracer level with increase in temperature. But no significant increase in glucan level can be seen in the graph (Fig. 4b).

Page 10 L 1: “Fungal spore tracer levels dropped on days when rain fell (e.g. 23 April, 2 May), due to particle removal by wet deposition”. The drop in tracer levels is visible only in coarse PM. The mannitol concentration in fine fraction actually shows an increase on 23 April as compared to the previous day without rain. Same is for glucan on 23 April. Also the relative contribution of fungal tracer in fine PM is high on these rainy days as compared to other dry days. Hence this statement is true only for tracer levels in coarse PM.

Page 10 L19: “which suggests an alternative non-fungal source of glucan”. Pollen is a likely source’. If glucan can have other non-fungal source including pollen, then how can it be used as tracer for fungal spore. The high increase in glucan in PM10 on 22 April (Page 9, L 26) might be due to pollens which are generally released during higher temperature.

Section 3.5: It is interesting to note that 92% of bacterial endotoxin is present in coarse

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fraction of PM. Generally one would expect bacterial endotoxin to be abundant in fine fraction of PM as bacteria are smaller in size. Authors have not given any satisfactory explanation for this low concentration of endotoxin in fine PM.

Page 13, L 21-22: “The release of pollens, fungal spores, and Gram negative bacteria in fine particles during rain events, as observed surrounding spring and late-summer rain events in Iowa, has the potential to influence human health”. This statement cannot be generalized at least for gram-negative bacteria during spring season where no increase in bacterial endotoxin in fine PM was observed during rain event.

Page 14, L 21-22: “Airborne fungal spore tracers, however, were suppressed by spring rain and increased in concentration following rain events”. I feel this line contradicts the statement given in page 13, L 21, ‘The release of pollens, fungal spores, and Gram negative bacteria in fine particles during rain events, as observed surrounding spring and late-summer rain events in Iowa, has the potential to influence human health’.

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