The Effect of Activated Carbon Exposure to The Cornea Histology of *Rattus norvegicus* That was Induced with Air Freshener

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INTRODUCTION

Nowadays, it is difficult to get clean and fresh air. Air pollution occurs everywhere, either in the open air, or indoors. One source of indoor air pollution that is not yet widely known by humans is air freshener. The use of air freshener gives the impression of air to be fresh by the scent emitted. Air freshener contains various organic volatile compounds (VOCs) that can endanger health, such as formaldehyde. In addition to the use of air freshener, granular activated carbon is widely used by people to absorb pollutants in the room air. Exposure to low concentrations of formaldehyde does not show significant damage to the cornea but, over a long period of time, cell morphology changes and tear production abnormalities (Lai Li-Ju, 2013). Granular activated carbon can also be used to reduce pollutants derived from VOCs (Deithorn, Robert, 2012)

The aim of this research is to know the use of activated carbon to cornea histology on *Rattus norvegicus* that was induced with air freshener.

METHOD

This research was an experimental study with a post-test only control group design. The subjects were 28 one-month old male *Rattus norvegicus* Wistar strains divide into 4 groups: Control (K), air freshener (P1), activated carbon (P2) and air freshener plus activated carbon (P3). The air freshener used for the treatment of the subjects is air freshener containing 0.62 ppm formaldehyde. The activated carbon used for the treatment of the subject is the granular activated carbon. The treatment was performed 8 hours/day for 35 days. Data of anterior epithelial thickness were analyzed by *One Way Anova* test. Data of the overall thickness of the corneal layer and keratocyte number were analyzed by *Kruskal Wallis* test.

RESULT

The cornea histology observation in this study is shown in the following figures :

Figure 1

Figure 2

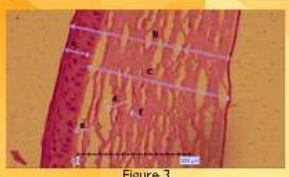

Figure 3

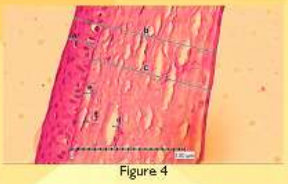

Figure 4

Description :

Figure 1. Histology images of the *Rattus norvegicus* cornea group (K) (control) (HE, 400x)

Figure 2. Histologic images of the cornea of *Rattus norvegicus* group P1 (exposed to gel air freshener for 8 hours / day for 35 days) (HE < 400x)

Figure 3. Histologic images of the cornea *Rattus norvegicus* group P2 (expressed on granular activated carbon for 8 hours / day for 35 days) (HE <400x)

Figure 4. Histologic images of the cornea *Rattus norvegicus* group P3 (expressed on granular activated carbon and gel air freshener for 8 hours / day for 35 days) (HE < 400x)

Caption: (a) anterior epithelium (b) Overall corneal thickness (c) stroma (d) vacuolization (e) Bowman membrane (f) Keratocyte

Table 1 : Observation Data Influence of Active Carbon Effect on Histology of *Rattus norvegicus* Cornea Induced by Air Freshener

Groups	Overall Thickness of the corneal layer (µm)	Anterior Epithelial thickness (µm)	Keratocyte Number
Control (K)	683,12 ± 57,44	157,38 ± 22,40	17,83 ± 1,50[c]
Air Freshener (P1)	817,28 ± 153,56	160,08 ± 11,59	25,80 ± 3,34[a]
Carbon (P2)	753,05 ± 79,40	155,72 ± 28,95	17,47 ± 3,07[c]
Carbon + Air Freshener	770,33 ± 65,30	159,97 ± 15,52	20,90 ± 0,43[b]

Data of anterior epithelial thickness were analyzed by *One Way Anova* test. Data of the overall thickness of the corneal layer and keratocyte number were analyzed by *Kruskal Wallis* test.

Description: Different letters on the column Keratocyte Number show significant differences in Kruskal-Wallis statistical test with Post Hoc Mann Whitney Test with a 95% significance level

The overall thickness of the corneal layer and anterior epithelial thickness showed that there were not significant difference between subject groups ($p>0,05$). Keratocyte number showed significant difference between subject groups ($p<0,05$), *Mann Whitney* test for Keratocyte number showed results P1>P3>K>P2.

DISCUSSION

P3 group corneal thickness (treatment of air freshener and activated carbon) is smaller than P1 group (air freshener treatment). Similarly, observations on the thickness of the anterior epithelium and the number of keratocytes. This indicates that activated carbon has the potential to reduce the impact of air freshener on the damage to the cornea, indirectly.

Activated carbon will absorb the formaldehyde emitted by air freshener, thus potentially reducing damage to the cornea caused by air freshener. This result is in accordance with the study by Pari *et al* (2004) which states that the use of activated carbon can reduce the levels of formaldehyde emission of research materials, so that free formaldehyde levels become reduced.

The number of keratocytes in the corneas of the P1 group subjects (air freshener treatment) showed the greatest number of all groups of subjects. The particles emitted by the air freshener are very small (about 0.1 µm), so they can penetrate the anterior epithelium of the cornea, into the stroma. Entry of these particles will activate dormant keratocytes, thus proliferating (Ruzer and Harley, 2013). This keratocyte proliferation contributes to the repair of damaged tissue. The absorption of air freshener particles by activated carbon will reduce the number of particles that penetrate the corneal epithelium, so the activated keratocytes become reduced. This is shown from the results of keratosit calculation on the subjects group P3 <P1.

CONCLUSION

Activated carbon gives postitive effect to reduce cornea histology damage on *Rattus norvegicus* that induced by air freshener.

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