

Amount of Polycyclic Aromatic Hydrocarbons (PAH) on Peels of Apples from Private Gardens in Örebro

Background

The advantages of ecological and nearby grown foods are often spoken about, but what is not spoken as much about is if traffic affects the toxicity of fruits and other foods grown in local private gardens. PAH stands for polycyclic aromatic hydrocarbons, which are cancerogenic organic compounds that forms when materials containing carbon are heated up under shortage of oxygen, for example in combustion engines. Road dust contains PAH from both combustion engines and tires. The road dust containing PAH sticks to the peels of nearby growing apples because the road dust gets stirred up by the wind and passing traffic. Earlier investigations have found that the highest amount of PAH is usually found approximately 200 meters away from roads with heavy traffic. This is explained by the theory that PAH rises in the form of a curve before sinking back to ground level again.

Purpose

The aim of this study was to investigate if 16 EPA priority PAH (PAH16) could be found on apple peels of apples grown in private gardens in different parts of Örebro County and if the eventual PAH16 amount is affected by the distance to the closest heavily trafficked road and whether the apples have been rinsed.

Full name	Shortening
Adolfsberg unrinsed	AO
Adolfsberg rinsed	AS
Järle unrinsed	JO
Järle rinsed	JS
Trädgårdsgatan unrinsed	TO
Trädgårdsgatan rinsed	TS
Blank sample 1	B1
Blank sample 2	B2

Position tree	Adolfsberg	Järle	Trädgårdsgatan
Distance to large road	550m	900m	5m

Method

The methods used included collecting of samples, extraction, concentration, clean up and an analysis. The apples used as samples were collected in three different locations, including Adolfsberg, Järle and Trädgårdsgatan. The apples were then frozen in aluminum foil to then be placed in beakers containing 1:1 n-hexane and acetone solvent. A PAH16 internal standard (IS) was added to all beakers. The beakers were placed in an ultrasonic bath for extraction of the contents of the apple peels. Two blank samples, without apples, were also made. Every apple sample went through the extraction process twice. The solvent from the beakers were then evaporated in a rotary evaporator, set at 39°C and 600mbar, to make the samples more concentrated. The pressure was gradually lowered to 340mbar. The water in the samples were removed by anhydrous sodium sulfate. The remaining fluids of the samples were then transferred to smaller containers and evaporated further by a nitrogen evaporator. The clean up was made with columns with a diameter of 1cm filled with glass wool and deactivated silica. The samples ran through the columns along with hexane and were then collected to be concentrated by the rotary evaporator as well as the nitrogen evaporator. Three solutions containing PAH16, IS and RS were made for calibrating. The samples were transferred to vials containing RS and were then concentrated through evaporation by the nitrogen evaporator. Toluene was then added to the vials and the samples were once more evaporated by nitrogen. The vials were then sealed and mixed by a vortex. All vials were placed in a GC-MS (Gas Chromatograph – Mass Spectrometer) and the analysis proceeded by the selected program. The results then showed up as a graph with peaks where the areas under the peaks determined the amounts of each PAH.

Discussion

According to the presented facts in the background to this study, phenanthrene is the most occurring PAH in road dust. This supports the fact that phenanthrene is the dominating PAH in the results of this study. In the background, a theory is presented that PAH16 is rising and then sinking after approximately 200m, this theory is partly supported by the result because of the fact that the lowest levels of PAH16 were found on JO and JS. The fact that AS had the lowest amount of PAH16 speaks against this theory. Some method improvements, that probably would have contributed to a more accurate result, could have been made. They include avoiding freezing the apples and using a smaller volume of solvent. Possible sources of error are that too few apples per category were investigated, that the samples spent different amounts of time in the refrigerator and the fact that some amount of PAH might have left the samples during the extraction.

Conclusion

From the results of the experiment can a conclusion be made that PAH16 occurs on the peels of apples grown in gardens. The amounts, however, are very low and classifies as almost undetectable. A connection between the distance to a heavily trafficked road and the amount of PAH16 on the peels can be assumed but is not confirmed since no apparent trend shows in the results. The amount of PAH16 does not necessarily decrease after the apple has been rinsed for two seconds under running water.

Results

The results do show that the amounts of PAH16 on the apples are approximately the same and there are only small differences. All samples have in common that phenanthrene is the dominating PAH. No clear connection between the amount of PAH16 and distance to a heavily trafficked road can be seen.

Diagram 1

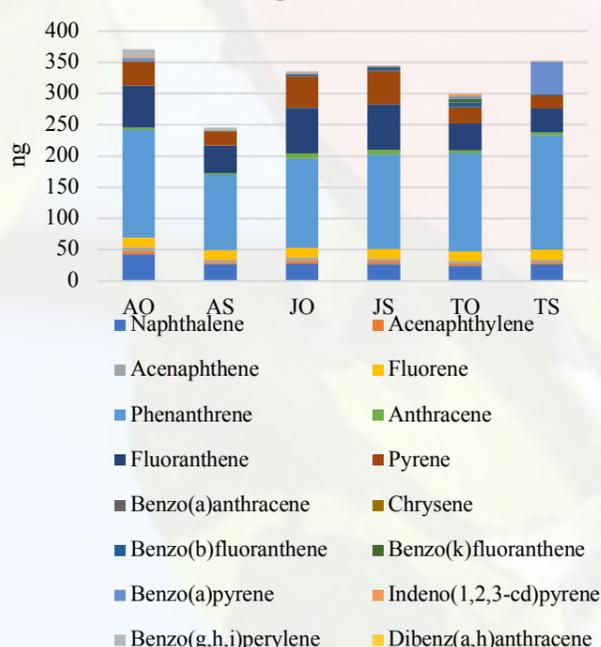


Diagram 2

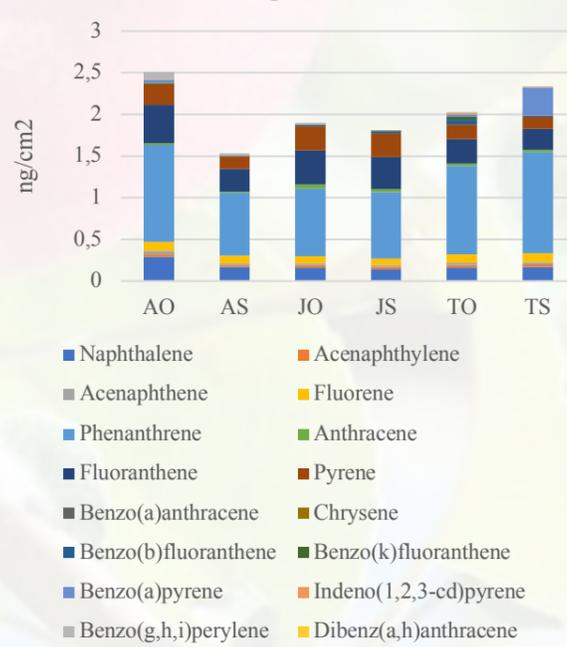


Diagram 3

