A. Introduction

Avian flu is a prevailing threat to mankind as the lethal virus H5N1 can pass from bird to human, enabling the small creature to be a carrier of a potential pandemic in near future. Found nearly everywhere, extremely mobile and intimate to human, the small creatures of birds are capable of, and proved to be effective agents to carry around the globe a potential pandemic, when they pass the virus to human like what has been happening.

Bird repellent is a substance that can keep birds away. One of the active ingredients in bird repellent is methyl anthranilate (MA). Methyl anthranilate is already being used in dispersing birds from the flight lines at Homestead Air Reserve Station (Engeman, 2002). Artificial methyl anthranilate is also marketed as commercial product such as Rejex-it ® TP-40.

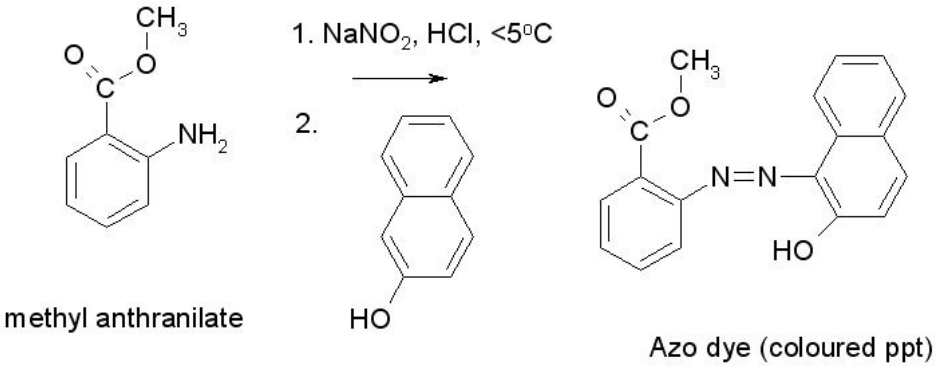
Being widely recognized as a strong bird irritant, methyl anthranilate is already being of practical use like in dispersing birds from the flight lines at Homestead Air Reserve Station, reducing bird damage to blueberries, and repelling birds at landfills and standing water in airports. Highly biodegradable, non-toxic and has numerous other uses like being UV screen and food additives, methyl anthranilate is indeed an advantageous bird repellent.

Rejex-It

Therefore, we are to investigate methyl anthranilate's qualitative and quantitative presence in various natural samples, including fruits, vegetables and plants, in order to work out some vegetation which is the most cost effective in serving as bird repellent. With this knowledge of cost-effectiveness, we can study the use of planting these highly cost effective vegetations in urban area by urban planning to keep birds away from these areas in order to contain Avian and check it from becoming a pandemic.

B. Principle

Methyl anthranilate is a strong bird irritant which can keeps birds away effectively. Its qualitative and approximate quantitative presence in vegetation can be detected by the formation of azo dye in diazotization. The relative quantity of azo dye formed reveals the relative amount of methyl anthranilate contents between vegetations. With their prices, the cost-effectiveness of such vegetations to serve as bird repellents can be compared.



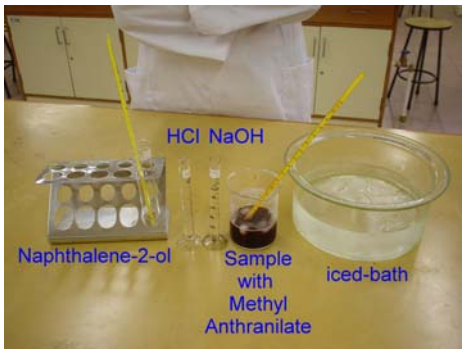
Reaction of diazotization

C. Investigation

This project focuses on mainly four parts:

Part 1: Comparing the amount of methyl anthranilate content in different samples

Diazotization was carried out to identify and compare the presence of methyl anthranilate in some fruits, tea leaves, vegetables and plants. Azo dye formed was filtered. The mass of azo dye formed was directly proportional to methyl anthranilate content in a sample. Therefore by comparing the mass of azo dye formed, the relative quantitative presence (in percentage content by mass) of methyl anthranilate can be compared.



Set-up of diazotization

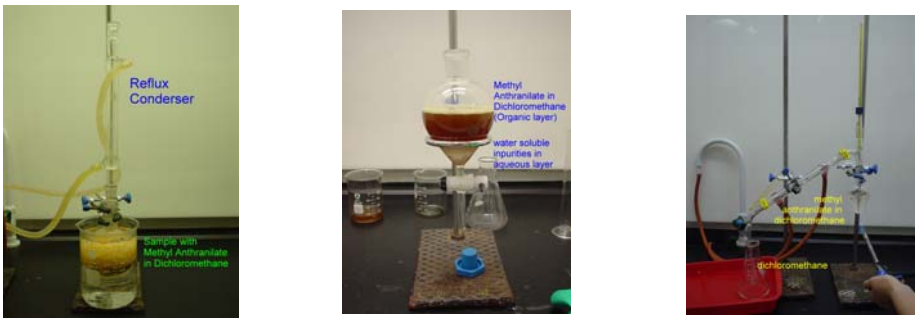
Set-up of filtration

Part 2: Characterization of azo dye

Azo dye formed was characterized by determination of melting point.

Part 3: Extraction and identification of methyl anthranilate

Extraction of methyl anthranilate from some samples was done by reflux, followed by solvent extraction and distillation. Thin layer chromatography was employed to identify the presence of methyl anthranilate in some samples.



(from left to right) Set-up of reflux, solvent extraction & distillation

Part 4: On-the-Spot Experiments

The shielding effect of methyl anthranilate as bird repellent in some samples of vegetation was investigated.

Experiment I: Pots of tagetes were grown with used jasmine tea leaves, jasmine tea leaves and Kalanchoe. Extent of damage of each pot of plant was inspected.

Experiment II: Food containing methyl anthranilate-containing substance was offered to birds and their behaviours were observed.

D. **Results and Findings:**

Part 1: Percentage by mass and cost of methyl anthranilate (MA) in some samples

	Fruit	Plant				Tea leave		Vegetable	
Sample	Strawberry 	Taiwan acacia 	Pelargonium 	Kalanchoe 	Impatiens 	Jasmine tea leaves 	Jasmine tea leaves (used) 	Sunflower seed 	Garlic 
% by mass of MA	0.831	0.610	0.259	0.158	0.109	0.686	0.192	0.173	0.154
Cost of MA ($/ g of MA)	7.22	0.00	86.9	0.00	0.00	9.48	0.00	19400	10.1

Methyl anthranilate was found mainly in the juice of fruits.

It was worth noticing that Jasmine tea leaves still retain as high as 28% of its methyl anthranilate content after first extraction. As used tea leaves were solid wastes, used jasmine tea leaves were highly cost-effective as bird

repellent.

Plants such as Taiwan acacia and pelargonium were found to contain comparable amount of methyl anthranilate as citrus fruits, so they can be planted at home, housing estates, schools or even suburban areas to repel birds.

Part 2: The range of melting point of azo dye was 115^{o}-120^{o}C.

Part 3: Samples of methyl anthranilate:

Sample	**Appearance of Methyl Anthranilate**		**Sample**	**Appearance of Methyl Anthranilate**	
Red grape juice	yellow liquid		Jasmine tea	yellow liquid, bluish fluorescence	
Orange (juice)	yellow liquid		Violet	yellow liquid, bluish fluorescence	
Pomelo (juice)	yellow liquid		Sunflower seed	yellow liquid	

Methyl anthranilate showed R_f at 0.15.

Part 4: On-the-spot experiment

Experiment I: Obviously, more leaves on the plant grown as control were eaten by birds. Others were also eaten by birds but to a smaller extent.

Experiment II: Obviously, birds turned away from food with methyl anthranilate-containing substances.

E. **Discussions:**

Densely populated areas, especially schools, hospitals, kindergartens and parks where the old, the sick and children are gathered, are more vulnerable to the attack of H5N1. Planting Taiwan acacia, kalanchoe, pelargonium and impatients in these areas could shield them from birds and hence check the cross-infection of the deadly virus between bird and man.

Used jasmine tea leaves were found to retain as high as 28% of its methyl anthranilate content after first extraction. As a solid waste which would be dumped otherwise, keeping used jasmine tea leaves at home is highly cost-effective as they not only serve as fertilizer but bird repellent.

Plant grown with used jasmine tea leaves (3) growing healthier with more blossoms than the control (1) months later.

Others: grown with jasmine tea leaves (4) grown with kalanchoe (2)

Birds stayed away from Taiwan Acacia

To compensate the loss of bird habitats, other plants could be planted in rural areas. As the 'Heaven of Birds", Hong Kong citizens can still enjoy the sight of birds in the countryside of Hong Kong.

To check the spread of Avian flu from becoming a pandemic, HKSAR government should take serious consideration of making green by planting methyl anthranilate-containing plants in urban area by urban planning. The public should be enlightened to the knowledge that wastes such as used jasmine tea leaves, citrus fruits and some spices contain methyl anthranilate which could keep birds away. In doing so, avian flu as a pandemic would be less prone to happening.