Relationship between Airborne Proteins in the Central Valley Area and Allergies

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ABSTRACT

Air quality in the Central Valley is among the worst in the United States, causing allergies and potentially long-term medical conditions. It is well known that allergens are proteins or glycoproteins that illicit an IgE antibody response. These nonvolatile molecules travel through the air on aerosol particles present in dust. Characterizing the protein composition of the dust particles should shed light on what is being breathed in by the general population. It is critical that sampling of aerosols simulate respirable conditions to the maximum extent possible. To accomplish this, a “button aerosol sampler” will be employed for sampling. The sampler is going to be placed on the rooftop of the Naraghi Building which is on the CSU Stanislaus campus in Turlock California. Samples will be collected on a weekly basis.

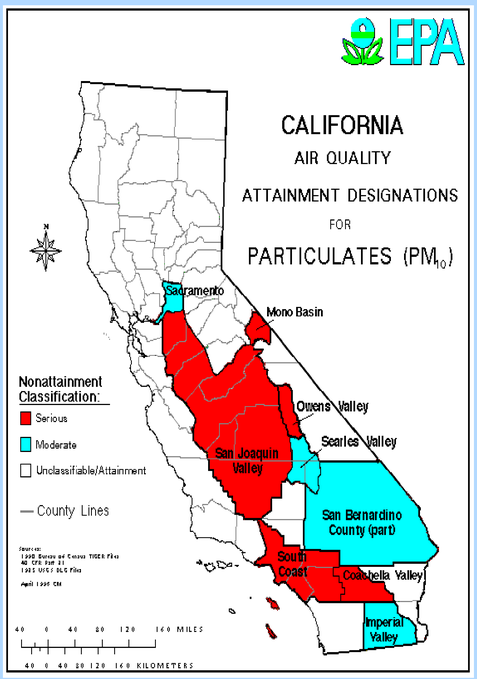

Figure 1: California regional air quality illustration.

INTRODUCTION

Here in the Central Valley there are many contributions to ambient particulate matter. Agriculture, ranching activities, fires, wind-blown dust, diesel and gasoline exhaust, power plant emissions, and home heating all play a role in in the particulate matter that is present here in our environment. The Central Valley of California has many individuals who face allergic reactions whether those reactions are epidemic or respiratory. Agriculture, ranching activities, fires, wind blown dust, diesel and gasoline engine exhaust are all activities that are very highly needed and take place here in the Central Valley (Smith et.al 2003). Sacramento was listed in the Huffington post as one of the worst US cities for allergies, and that is because of the high particle concentration (Schocker, L., 2011).

Characterizing the protein composition of the dust particles should shed light on what is being breathed in by the general population. It is critical that sampling of aerosols simulate respirable conditions to the maximum extent possible. To accomplish this, a “button aerosol sampler” will be employed for sampling the air particles. This will allow us to collect an amount of inhalable dust and determine which allergens are most abundant during different seasons. Samples will be collected using borosilicate glass filters with a nominal pore size of 1.0 µm. Dust will be sampled for a period of one week on the CSU Stanislaus campus. Proteins from the dust samples will be solubilized via a Lowry protein assay. Proteins will then be separated by SDS-PAGE[6], through this, protein bands will be excised and digested with trypsin. Mass spectrometry will then be used for protein identification.

METHODS

Aerosol Sampler

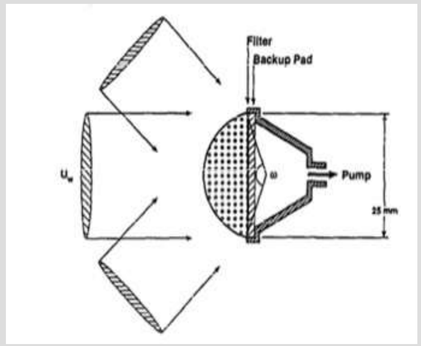

Figure 2: Schematic diagram of the aerosol sampler with multi-directional sampling capability. The pump will be ran for 7 days at 7 L/min.

Sample Preparation

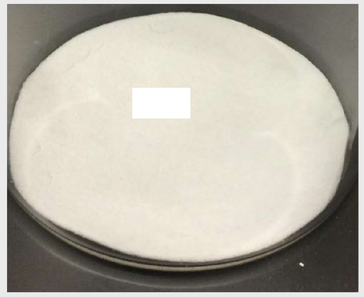

Figure 3: A clean filter before sampling.

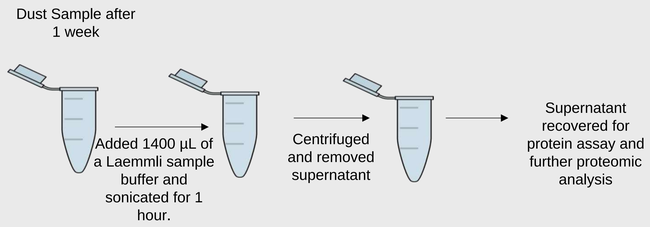

Figure 4: Schematic of sample preparation for protein assay.

Mass Spectroscopy

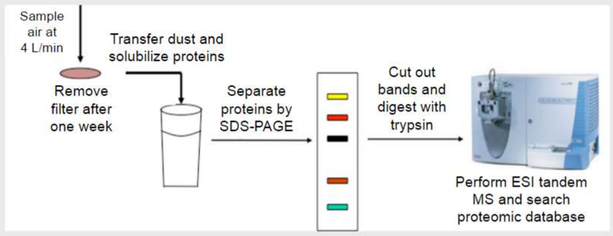

Figure 5: Flowchart of procedure: Sample obtained from Aerosol Sampler will be solubilized and then ran Gel electrophoresis on. Bands will be separated and be digested in trypsin. ESI Tandem MS will be performed.

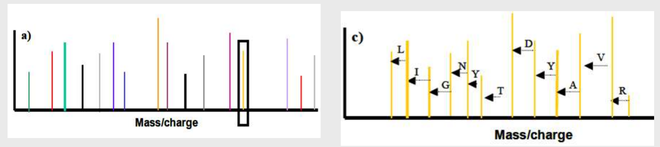

Figure 6: Data to be attained will be a mass spectrum scan, followed by a tandem mass spectrum to yield peptide sequence information. Tandem MS data will be searched against a proteomic database for protein identification.

EXPECTED RESULTS:

This study will characterize the many airborne proteins present in our environment. By collecting dust samples in the Central Valley throughout the year, we will be able to determine what proteins are present and their quantities at different seasons throughout the year. With the use of mass spectrometry and a proteomics database, the proteins in the collected dust samples will be identified. It is expected that at the peak of allergy season is when the most proteins will be detected. It is also anticipated that many proteins found will not match those on the database. For these proteins, amino acid sequence homology matching will be performed using Basic Local Alignment Search Tool (AKA: BLAST) algorithms to determine the similarity of unmatched proteins to known allergen sequences. This knowledge may lead to a new and improved treatment option for individuals who are allergy prone.

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What is ELISA? Enzyme-linked immunosorbent assay (ELISA). (n.d.). Retrieved from http://www.elisa-antibody.com/ELISA-Introduction