

# CSEF Official Abstract and Certification

Word Count

238

Fair Category

PS

Project  
Number

6041

**Title:** Modeling Investigation on Amines and Sea-salt Aerosol Interactions to Assess Their Potential Climate Impacts

**Student Name(s):** P. Sundararajan

## Abstract:

Aerosols are solid or liquid particles suspended in air. Sea salt aerosols assist in the formation of clouds and can mitigate the warming trend of the climate. It also can react with sulfuric acid (SA) to release hydrochloric acid (HCl) gas. Amines are derivatives of ammonium typically found in coastal areas. They can react with acids (ex. SA) in aerosols to change their properties. Since HCl is more volatile than SA and closely related to sea salt aerosols, our project aimed to investigate if amines will react with HCl to form amine chloride salts, and if so, at what temperature. We hypothesized that amines will react with HCl and condense on sea salt aerosols at low temperatures. To assess our hypothesis, the Extended AIM Thermodynamic Model (E-AIM) was used to evaluate a chemical system at equilibrium across gas, aqueous, and solid phases. Multiple simulations were conducted on scenarios with constant inorganic concentrations and varying amine concentrations for alkylamines (ex. methylamine and dimethylamine) and polyamines (ex. monoethanolamine and piperazine) from 263.15K to 330K with 50 temperature intervals. We found that alkylamines only condense with HCl at low temperatures (285 K) but polyamines do at moderately higher temperatures (300 K). Our results advance the current understanding on interactions between amines and aerosols and improve current atmospheric models. Our findings also further knowledge on the crucial role of aerosols in cloud formation, light scattering, global radiation balance, and climate change.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EV AT EA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- |                                             |                                                                  |
|---------------------------------------------|------------------------------------------------------------------|
| <input type="checkbox"/> human subjects     | <input type="checkbox"/> potentially hazardous biological agents |
| <input type="checkbox"/> vertebrate animals | <input type="checkbox"/> controlled substances                   |

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No

3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No

4. Is this project a continuation? ☐ Yes ☒ No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

## American Meteorological Society

|               |                                                                                                                                                                        |            |                      |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------------|
| Award         | Certificate & \$25 gift card given by CSEF                                                                                                                             |            |                      |
| School        | Engineering and Science University Magnet                                                                                                                              | New Haven  | Roger Rushworth      |
| Project Title | Implementing Nontoxic Modified Magnetic Metal Oxide Nanoparticle Enhanced Biochar Filtration for the Efficient Removal of Emerging Contaminants in an Aqueous Solution |            |                      |
| Proj. No.     | 3009                                                                                                                                                                   |            |                      |
| Student(s)    | Snigtha Mohanraj                                                                                                                                                       | Grade 9    | Town Ansonia         |
| Award         | Certificate & \$25 gift card given by CSEF                                                                                                                             |            |                      |
| School        | Brunswick School                                                                                                                                                       | Greenwich  | Dana Montanez        |
| Project Title | A comparative analysis of the presence of microplastics in soil and rainwater between rural areas, urban areas, and areas adjacent to trash burning facilities         |            |                      |
| Proj. No.     | 3510                                                                                                                                                                   |            |                      |
| Student(s)    | Jackson Wolfram                                                                                                                                                        | Grade 11   | Town Riverside       |
|               | Tomas Delgado                                                                                                                                                          | Grade 11   | Town Riverside       |
| Award         | Certificate & \$25 gift card given by CSEF                                                                                                                             |            |                      |
| School        | Greenwich High School                                                                                                                                                  | Greenwich  | Andrew Bramante      |
| Project Title | Simple Remediation of Heavy Metal and Fertilizer Runoff Water Contaminants via Carbon Nanotube Infused Pinus strobus Xylem Filtration                                  |            |                      |
| Proj. No.     | 6027                                                                                                                                                                   |            |                      |
| Student(s)    | Justin Bernstein                                                                                                                                                       | Grade 9    | Town Greenwich       |
| Award         | Certificate & \$25 gift card given by CSEF                                                                                                                             |            |                      |
| School        | Amity Regional High School                                                                                                                                             | Woodbridge | Catherine Piscitelli |
| Project Title | Modeling Investigation on Amines and Sea-salt Aerosol Interactions to Assess Their Potential Climate Impacts                                                           |            |                      |
| Proj. No.     | 6041                                                                                                                                                                   |            |                      |
| Student(s)    | Pranav Sundararajan                                                                                                                                                    | Grade 12   | Town Orange          |
| Award         | Certificate & \$25 gift card given by CSEF                                                                                                                             |            |                      |
| School        | Bridgeport Aquaculture Center                                                                                                                                          | Bridgeport | Kirk Shadle          |
| Project Title | Utilizing Rooftop Gardens as a Means of Geothermal Energy Through Ground to Air Heat Transfer Systems                                                                  |            |                      |
| Proj. No.     | 6063                                                                                                                                                                   |            |                      |
| Student(s)    | Aidan King                                                                                                                                                             | Grade 12   | Town Milford         |