

# THE WAGNER FREE INSTITUTE OF SCIENCE

CHEMISTRY SERIES – WINTER 2019

**Recycling Realities**

**Professor Kevin Cannon**

This course will meet at the **Falls of Schuylkill Branch of the Free Library**, 3501 Midvale Avenue, Philadelphia, PA.

**Dates:** 6 Mondays, March 4 – April 8, 2019

**Time:** Classes meet from 6:30 to 7:45 PM

**No pre-registration required. Please register by completing a registration form at the class.**

## Course Description

In 1960, 94 % of the municipal solid waste generated in the United States was disposed of in landfills or open burn pits. In 2013, the majority of waste was still landfilled (53%), but 34 % was recycled and 13 % was burned with energy recovery. Changing technologies, waste compositions, regulations, and increasing environmental awareness drives how we and the rest of the world treat solid municipal waste. Despite what looks like a promising trend, total municipal waste generation in the United States tripled. Thus, as increasing amounts of wastes are placed in landfills, such disposal comes with significant short-term costs (financial and environmental) as well as potential long-term costs (resource depletion).

This course will survey current recycling technologies and policies, with emphasis on the recovery of value from municipal solid wastes. In addition to addressing the recycling of glass, paper products, food wastes, and traditional common metals (iron, aluminum, copper, etc.), special attention will be paid to plastics and technology metals recycling.

## Course Schedule

### **1. Monday, March 4, 2019 – General overview of recycling; introduction to plastic wastes**

The course will start with a general overview of waste handling strategies in the United States and abroad, with particular attention to the current handling of plastic waste. Current U.S. plastic waste strategies will be compared to current strategies in Europe and China.

### **2. Monday, March 11, 2019 – Technical, economic, and ecological aspects of plastic waste handling**

Technical aspects of plastic recycling for various applications and specific types of plastics will be reviewed. Economic and ecological values of current waste handling strategies will be compared to show the advantages of plastic recycling.

### **3. Monday, March 18, 2019 – Recycling and sustainable utilization of technology metals**

Within a few decades, the number of metals used has increased from approximately 10 to 40. Most of these “new” metals are necessary for optimal performance of high-technology products that have become an essential part of our society. Yet, many of these metals are “one and done,” discarded after use, with recycling rates <1 %. We will review the current issues associated with metal sustainability related to these new specialty metals.

#### **4. Monday, March 25, 2019 – Global metal sustainability**

A more comprehensive look at metal life cycles will be presented that will include precious, specialty, toxic, and radioactive metals. Issues related to sustainability as well as those involving health, environmental, and political issues will be discussed.

#### **5. Monday, April 1, 2019 – Diverting food wastes from landfills**

In 2013, food wastes accounted for approximately 15 % of the 250 million tons of waste generated in the United States; by weight, it was second only to paper-related waste. Efforts to reduce the amount of food waste in municipal solid waste will be discussed.

#### **6. Monday, April 8, 2019 – Glass and paper products recycling: How well are we doing with our current technologies?**

Glass and paper products account for nearly a third of the waste generated in the United States. Incineration with energy recovery is an alternative option to recycling for paper, but not for glass. Are your efforts in creating a recycling stream at home for these products paying off? The status of glass and paper recycling, along with the technology and environmental impacts associated with recycling, will be reviewed.

Monday, April 15, 2019 – Make-up class (if needed)

#### **Suggested Readings**

“Understanding Plastics Recycling: Economic, Ecological, and Technical Aspects of Plastic Waste Handling” Natalie Rudolph, Raphael Kiesel, & Chuanchom Aumnate, 2017, Hanser Publications, Cincinnati. ISBN: 978-1-56990-676-7, E-Book ISBN: 978-1-56990-677-4

“Metal Sustainability: Global Challenges, Consequences, and Prospects” Edited by Reed M. Izatt, 2016, John Wiley & Sons, ISBN-13:978-1119009108, ISBN-10: 9781119009108

#### **About the Professor**

**Dr. Kevin Cannon** is an Associate Professor of Chemistry at Penn State Abington College and a Research Associate at Temple University. He has done chemical work in bomb-detection, car paint, oil spill remediation and natural product synthesis. He has an ongoing interest in the history of science, particularly 18<sup>th</sup> and 19<sup>th</sup> century science which includes the development of the periodic table. He has been teaching for the Wagner since 2015.

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