Laundering money—literally—could save billions of dollars

8 January 2014

A dollar bill gets around, passing from hand to hand, falling on streets and sidewalks, eventually getting so grimy that a bank machine flags it and sends it to the shredder. Rather than destroying it, scientists have developed a new way to clean paper money to prolong its life. The research, which appears in the ACS journal *Industrial & Engineering Chemistry Research*, could save billions and minimize the environmental impact of banknote disposal.

Nabil M. Lawandy and Andrei Smuk point out that replacing old currency is a growing problem. When bills become too dirty, central banks take them out of circulation and replace them with crisp new bills. As a result, the world's treasuries print nearly 150 billion new banknotes every year at a cost approaching $10 billion. And about 150,000 tons of old bills become destined for shredding and disposal. The main culprit for this costly turnover is human sebum, the oily, waxy substance the body produces to protect skin—also the bane of acne-prone teenagers. Over a bill's lifetime of about 3 to 15 years depending on the denomination, sebum accumulates on its surface, reacts with oxygen in the air and turns a yellowish hue. To delay a banknote's retirement, Lawandy's team decided to see if they could just clean it, removing the accumulated sebum.

They turned to "supercritical" CO2, which acts like both a gas and a liquid and is commonly used in other cleaning applications. When they tested it on banknotes from around the world, they found that it effectively removed oxidized sebum and motor oil while leaving intact security features such as holograms and phosphorescent inks.

More information: "Supercritical Fluid Cleaning of Banknotes" *Ind. Eng. Chem. Res.,* Article ASAP. DOI: 10.1021/ie403307y

Abstract

With nearly 150 billion new banknotes being manufactured and printed every year around the world, the replacing of unfit currency is approaching $10 billion annually. In addition, central banks must also deal with the environmental challenge of annually disposing of nearly 150,000 tons worth of notes unfit for recirculation. Seminal work by the De Nederlandsche Bank (DNB) has identified that soiling is primarily a yellowing of the notes due to the accumulation of oxidized sebum. We show that supercritical CO2 (SCCO2) can be effectively utilized to remove sebum and other oils and contaminants, including common bacterial colonies, from both paper and polymer banknotes without destroying the costly and sophisticated security features employed by central banks to prevent counterfeiting. SCCO2 cleaning at 60°C and 5000 psi was shown to be effective in cleaning conventional straps of 100 banknotes, extracting nearly 4% of the initial strap weight. Measurements of note soiling distributions on a banknote sorting machine running at 10 banknotes per second showed a significant shift in soiling levels after cleaning, supporting the claim that processing of SCCO2-cleaned notes would result in significantly fewer notes being classified as unfit due to soiling and shredded.

Provided by American Chemical Society