Introduction

As we enter the Final Four of the NCAA basketball tournament, we consider the term "March Madness" and explore the environmental cause of the condition known as "March Madness".

Historically, basketballs were made with a leather cover. However, due to the effects of the harsh environmental conditions of outdoor courts, a desire for greater longevity at the consumer level and reduced cost, the majority of current balls are composed of synthetic or rubber materials. Although the NBA uses synthetic materials, NCAA regulation basketballs are still required to be covered in leather or composite leather materials, given that these matches are held indoors on wood floors. The synthetic materials can provide more consistency between balls, better grip and handling, and do not need to be broken in prior to use; however, the leather balls will bounce better. When the NBA switched to synthetic materials, the players were bothered by the decrease in rebound height and reverted back to the traditional leather balls, which are used currently. This practice of switching between synthetic and leather balls was certainly vexing for players, but was not likely be the cause of afore-mentioned madness. We wanted to track down the real source of this apparently contagious insanity, so it was off to the lab with our basketballs. Since most of us play with used basketballs, and rarely go mad, and it was likely that new basketballs would be used during tournament play, we considered new basketballs as the test articles, and used samples as the controls.

Procedure

Fourier Transform Infrared Spectroscopy

According to spectrographic analysis, the two basketballs investigated in this study are composed of synthetic leather materials, the new ball made of a polyurethane and the used ball a polyester urethane (see Figure 1). The difference in the material selection is likely the result of proprietary formulations used by each manufacturer. Although a decrease in cost and increase in durability be appealing in some quarters, will that material choice make the players or fans more susceptible to this insidious "madness"?

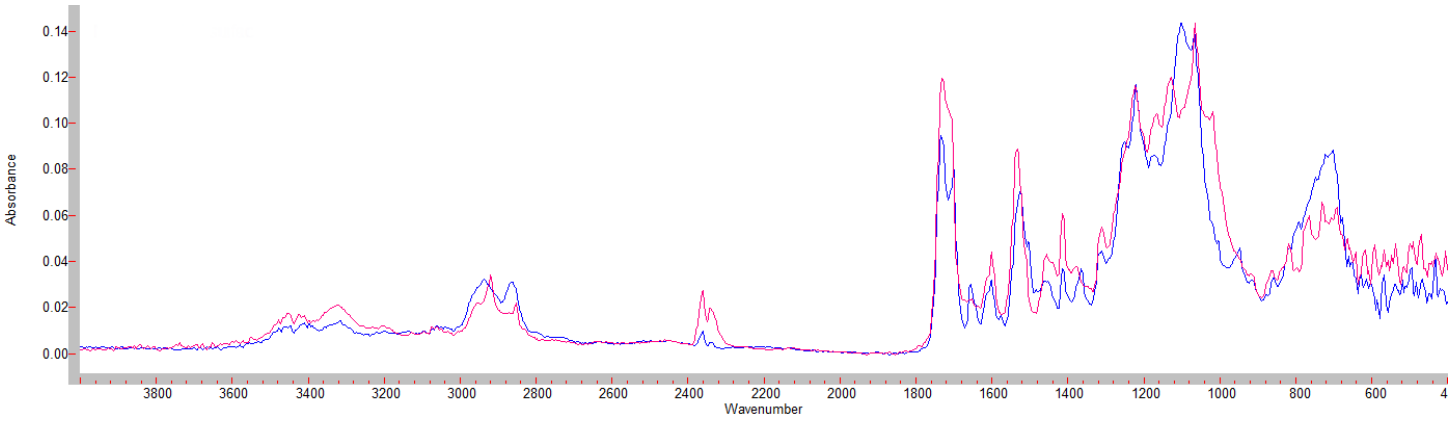

Figure 1: FTIR spectral comparison of the new (blue) and used (red) basketball material.

Surface Morphology

Scanning electron microscopy (SEM) was used to compare the surface morphology of the new and used basketballs. Visible by eye, both basketballs' surfaces are covered with small raised bumps which are designed to improve the player's ability to grip the ball by providing a rougher surface with increased surface area. Using SEM, we revealed more detail in the surface topography and saw notable differences between the new and used basketballs. Within the visible, macroscopic bumps in the new ball, smaller bumps cover the surface more or less uniformly. However, the micrographs of the used ball show that those smaller bumps have worn away, making regions of the surface smoother and providing less grip-ability. Also observed on the used ball are tears in the surface, appearing as crevices and fissures in the material.

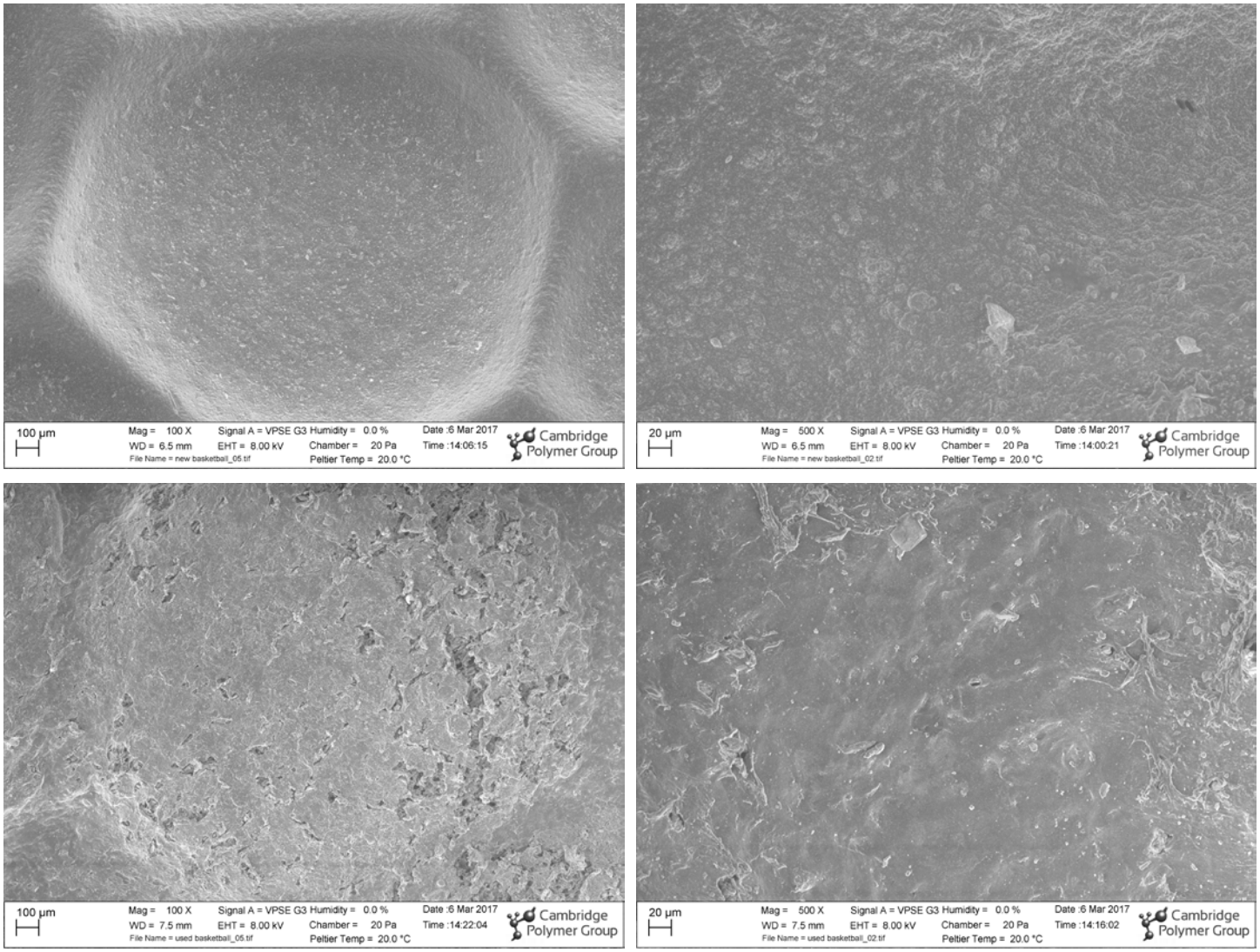

Figure 2: SEM micrographs of new (top row) and used (bottom row) basketballs revealing the differences in surface morphology between the balls. Micrographs were captured at 100X (left) and 500X (right).

Volatile Components

Since the previous two analyses provided no characteristic that could cause madness, we turned to potential volatile compounds, some of which are known to cause hallucinations (see the Oracle of Delphi), and yes, madness. We were interested in the fingerprint of compounds present near the surface of a new and an old basketball. A commonly used technique for analysis of volatile compounds is head space gas chromatography (HS-GC-MS), a method we often use to look for residual solvents and trace volatile chemicals in materials.

In this technique, samples of the new and old basketball were loaded into sealed vials and heated under controlled conditions. The evolved gases were transferred to a gas chromatography column which separates compounds on the basis of boiling point and affinity for the stationery phase of the column. After separation in the column, the compounds were analyzed by a mass spectrometer which measures a characteristic electron impact fragmentation spectrum which can be used to “fingerprint” the compound and identify unknowns by screening against a National Institute of Standards and Technology mass spectral library.

HS-GC-MS analysis is especially powerful in determination of flavor and odor causing compounds. A group of volatile compounds present only in the new basketball were identified by HS-GC-MS:

- ethyl acetate, a compound with agreeable odor, which is present in confectionary, perfumes and fruits
- methyl cyclohexane, an organic solvent detected at surprisingly high concentration
- butylated hydroxytoluene (BHT) – an antioxidant commonly added to cosmetics, pharmaceuticals and rubber

Since BHT is used in many commonly used items outside of basketball, and ethyl acetate has an agreeable odor (no madness there), we move the methyl cyclohexane into a suspect category as a possible source of March Madness, although further testing would be required to determine a causal link, probably involving popcorn and televisions. Once we figure out how to screen for madness-induction from shoe squeaking or vuvuzelas, we will conduct a follow-up study.

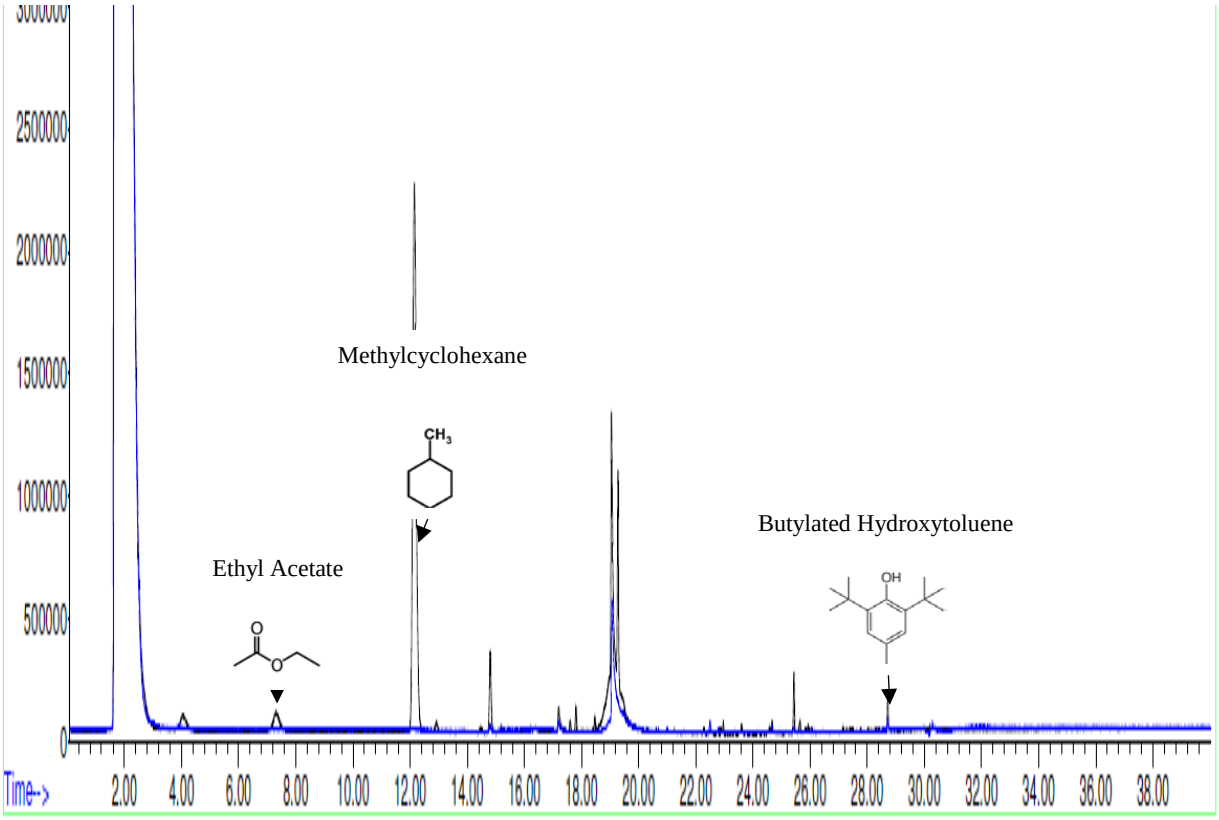

Figure 3: Total ion chromatogram of a new basketball (black color) and a used basketball (blue color). Compounds labeled with the arrows were detected and identified only in a new basketball.