There really is something unique about Tennessee whiskey, study finds.

Enlarge / White lightning distilled alcohol streams out of a still. It must be filtered through charcoal before barrel aging to be legally branded “Tennessee whiskey.”
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Scientists are beginning to unlock the scientific secrets of what makes so-called “Tennessee whiskey” so distinct from other whiskeys, bourbons, and similar spirits, according to a presentation last weekend at a meeting of the American Chemical Society in Orlando, Florida. Specifically, they’ve identified many of the key aroma-active compounds responsible for the beverage’s distinctive flavor profiles.

“We’re aiming to create a methodology, a practical tool, to reproducibly measure the changes that happen to guide distillers,” said lead investigator John Munafo of the University of Tennessee. “By mapping out all the different compounds, we can better understand what each one contributes, and in what concentrations, so distillers can tweak [those parameters] to get the flavor profile they want. That variety is what makes whiskey so interesting.”

Munafo spent 12 years as director of flavor science and plant chemistry at Mars Incorporated, working primarily with

chocolate (naturally). He’s doing similar chemistry research at the University of Tennessee, frequently partnering with local agriculture and industry, like Sugarlands Distilling Company in Gatlinburg. Sugarlands makes an award-winning whiskey called Roaming Man, and it’s keen on gaining a better understanding of the underlying science of its distillation process.

“People think Tennessee whiskey is just whiskey made in Tennessee,” said Trent Kerley, a graduate student in Munafo’s lab who presented the research at the ACS meeting. But Tennessee whiskey is distinct from bourbon, even though both are composed of 51 percent corn combined with rye and barley and then barrel aged. Fresh make distillate for Tennessee whiskey undergoes an extra filtration step prior to barreling called the Lincoln County Process, aka “charcoal leaching.” (The moniker comes from the Tennessee county where Jack Daniels set up its first distillery.) If it doesn’t go through that process, it can’t legally be sold as Tennessee whiskey, although different distilleries have their own methodologies within that requirement.

Enlarge / Sour mash cooks in fermenting tanks at Jack Daniel’s Distillery in Lynchburg, Tennessee.
Luke Sharrett/Bloomberg/Getty Images

Charcoal is a common substance used for filtration in distillation, and the charcoal chips used in the Lincoln County Process are made from selected sugar maple trees native to the region. Filtering the whiskey through charcoal is thought to improve its flavor by jump-starting the aging process, removing more congeners, even before the whiskey is poured into charred oak barrels for aging. “Originally, people drank unaged ‘White Dog’ whiskey,” said Kerley. “So they would treat it with the charcoal to mellow it out, because it was significantly harsher than the whiskey we drink today.”

Sugarlands provided them with the distillate and the maple charcoal they used in their experiments. First, Munafo and Kerley established a baseline flavor profile by analyzing the distillery’s unfiltered whiskey with a combination of two techniques: gas chromatography-mass-spectrometry and gas chromatography-olfactometry. (The latter tool enabled them to sniff out the individual components as the compounds were

separated.) Next, they used aroma extract dilution analysis to tease out which compounds were most critical to the whiskey's flavor profile, and in what concentrations.

The team then soaked several other batches of distillate in the charcoal for between one to five days and analyzed those resulting samples. "If you taste the control that hasn't been treated, and the one that has been treated, there is clearly a reduction of these harsh attributes," said Munafo. That difference in flavor corresponded to the significant changes they measured in the chemical composition of the unfiltered and filtered whiskeys. The levels of some classes of compounds decreased by as much as 30 to 50 percent.

Kerley and Munafo just presented a sampling of their study results at the ACS meeting. It's the basis for Kerley's master's thesis, and a paper discussing the full study will be submitted to the *Journal of Agricultural Chemistry* at the end of the year. "The ultimate goal is to characterize the whole process, including the aging process [in the barrel]," said Munafo. "We're just starting to get an idea of the impact of the different process parameters on the final product."

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