

Starnes' patent promises better plastic along with safer world

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What excites Floyd Dewey Gottwald, Sr. Professor of Chemistry William Starnes most about his recently patented organic stabilizers for PVC isn't the tremendous monetary potential the invention could bring him, the College and his department. It's the idea that his contribution to the growing \$1.8-billion heat stabilizers industry could help save lives.



One of the most widely used plastics in the world, PVC, or poly(vinyl chloride), has been attacked for its potentially adverse environmental effects. When heated, PVC tends to degrade. To prevent this degradation, heat stabilizers are added to the polymer. Until now, the problem has been that the best, most effective stabilizers contain heavy metals which are often toxic and environmentally unfriendly. While the PVC industry is cautious about how and where these kinds of stabilizers are used, environmental groups aren't satisfied. But Starnes and his research team have discovered a solution that benefits both sides of the debate.

They're called ester thiols, and they're non-toxic, unique organic materials that work as stabilizers for PVC. And they work just as well as the toxic metal ones often used now. But their value doesn't stop there. PVC can be either rigid or flexible. To make it flexible, low molecular weight compounds called plasticizers must be added. The ester thiols Starnes has discovered are so compatible with the polymer that when used at high levels, they also serve as plasticizers—non-toxic plasticizers.

Photo: William Starnes shows off one of his patented compounds. By Tim Jones.

“If people throughout the world can use PVC without some of the concerns now associated with it, then literally, we're talking about saving lives, particularly in countries with less-strictly enforced environmental laws,” said Starnes.

Found in vinyl siding, plastic flooring, shower curtains, plastic blinds, credit cards and numerous other products, PVC shows up in nearly every area of normal daily life. Starnes' invention can make each and every PVC application safer without sacrificing stability, and that's what's attracting the attention of major chemical companies worldwide.

Earlier this month, the Hampton Roads Technology Council gave Starnes its annual Excellence in Innovation award for the recently issued patent for ester thiols.

Starnes is now working through William and Mary's Technology Transfer Program in cooperation with Edison Polymer Innovation Corporation (EPIC) in Ohio—the same company he worked with to develop the technology—to license it. If EPIC is successful in negotiating a licensing agreement that leads to commercialization, Starnes and the College will receive a major portion of product royalties.

“There's been considerable industrial interest in these compounds as stabilizers and as plasticizers, so

there is a lot of potential,” Starnes said. “We’re guardedly optimistic. There’s absolutely no question that this technology works, so if it’s not commercialized, it will be for purely economic reasons.”

One of the struggles many scientists face—university scientists particularly—is getting their discoveries out of the lab and into the commercial world. The College’s Technology Transfer Program, directed by Joy Bryant, provides the support professors need to get their inventions patented, licensed and out for public consumption.

“We discovered that Dr. Starnes had some innovations that we thought were very meritorious inventions, and we wanted to get them started in the patent process right away,” she said.

Getting an invention patented is no small or quick task. It usually takes years—more than three in Starnes’ case—just to get a patent approved. But in the long run, the wait is worth it. Through EPIC, Starnes has filed patents internationally. Since his research in heat stabilizers and ester thiols continues to produce new advancements, Starnes already has five additional patents enduring the approval process. Two have received notices of allowance.

And while his current patent, which the Hampton Roads Technology Council honored for its “significant commercial potential and/or social benefit,” has attracted attention from chemical companies, Starnes believes the forthcoming patents are perhaps more important overall.

Throughout his research, Starnes has been assisted by three postdoctoral fellows, Bin Du, Soungkyoo Kim and Vadim Zaikov, and one recent William and Mary Ph.D. graduate in applied science, Xianlong Ge. Du’s and Kim’s names will appear on patents. Currently, William and Mary senior Elizabeth Culyba, a chemistry major, is researching the mechanism of action for ester thiols. According to Starnes, her research has produced some extraordinary results already.

But even when the research gets exciting, Starnes stays focused on the ultimate benefit of what he does—how this innovation can take a thermoplastic, one of the most important and useful plastics in the world, and make it safer and even more useful.