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Why Not Teflon? Science's Battle with Non-Stick

Why Not Telfon?

Science's Battle with Non-Stick

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The kitchen section at the Oberlin Walmart has a myriad of pots and pans, but non-stick pans are clearly the dominant option. On a shelf to the side, amid assorted culinary oddities, there's one stack of cast iron skillets, in one size. This contrast mirrors a common belief that new technologies are better than old ones. Now, only 50 years after the American introduction of non-stick pans, the 3,000-year-old technology of cast iron is obsolete to most consumers.

Polytetrafluoroethylene, or PTFE, commonly known by the DuPont trade name Teflon™, was invented in 1938 at DuPont during work related to the development of safer refrigerants and was the first non-stick surface. The chemical was noted to have extremely low friction and to be highly heat- and chemical- resistant. In 1951 DuPont began manufacturing commercial Teflon bakeware, but did not make consumer pans, due to worries that toxic gases could be released when Teflon was overheated. The invention of non-stick consumer cookware was patented in France in 1954, and the company, Tefal, began production in 1956. In 1960, the United States Food and Drug Administration (FDA) approved Teflon for contact with food, following tests where aged non-stick cookware produced higher levels of Teflon in a hamburger. The FDA, however, judged the measured levels to be insignificant.

Since then, non-stick consumer cookware has flourished and can be found in home kitchens around the world. Over the years, both environmental and health concerns have been raised about the safety of these products. The highest-profile case is that of Perfluorooctanic acid, or PFOA. PFOA was a chemical solvent used in production of Teflon coatings. The US Environmental Protection Agency (EPA) has been concerned about PFOA because it decays very slowly and has been found at detectable levels in the environment and in human bloodstreams, although it is not produced naturally. Furthermore, it has been found to cause various health defects in lab animals, including cancer and developmental problems.

PFOA isn't the only concerning aspect of Teflon cookware. The Environmental Working Group surveyed peer-reviewed literature about the thermal degradation of Teflon, including several studies by DuPont scientists, which detected emissions of toxic particulates at temperatures as low as 464°F, and emissions of toxic gases at temperatures of 680°F and above. Both of these temperatures can be easily reached on a stovetop. Additionally, a syndrome known as "Polymer Fume Fever" was identified in many DuPont workers, with symptoms similar to the common flu. It is unknown whether any in-home use of Teflon products have resulted in Polymer Fume Fever, which was often initially mistaken for the flu.

The industry has responded to these concerns by looking for new ways to produce alternative non-stick surfaces. Several companies, including DuPont, now produce Teflon coatings without using PFOA, while others have developed coatings that are supposedly safe. Two examples are Ecolon, which uses a type of nylon as a non-stick coating, and Thermolon, which uses a mineral-based coating. According to these responses, it is believed within the industry that advances in new technology will solve the problems of conventional non-stick products.

Before non-stick pans existed, cast iron was very popular for cookware, particularly skillets and dutch ovens. Cast iron cookware has been used for over 3,000 years. Cast iron was valued for its high heat retention, long lifetime (individual pans have been known to be used for more than 100 years), and, believe it or not, for its non-stick properties. Bare cast iron is far from non-stick, but when oil is heated in cast iron, it polymerizes and forms a nonreactive coating that clings to the porous structure of the iron through a process known as "seasoning". Cast iron is also known to have at least one adverse health effect: small amounts of iron seep into the food. While this can have detrimental effects in people who have excessively iron-rich diets, this supplemental iron is considered beneficial in most cases.

A trouble with cast iron is that it is not quite user-friendly. Most cast iron pans come unseasoned, so you must learn to season them. Additionally, the seasoning may be damaged by acids, and it thus takes knowledge and practice not to damage the seasoning with overly acidic foods. Cast iron has a high heat capacity, which means you have to preheat pans for longer and wait longer for them to cool. But if you take some time to master the use of cast iron, there are endless benefits, such as more even cooking, non-stick properties with benefits both for cooking and cleaning, the option of using pans in the oven as well as on the stovetop, and genuine improvement of the pan over time.

So what drove the success of non-stick cookware? It seems to have been due in large part to the convenience of non-stick. The main reason that DuPont cites for buying Teflon cookware is that the pans are easier to clean. But are they truly easier to clean than cast iron? There is no sure way to test this claim, but many people claim that with properly seasoned cast iron, a rinse with hot water is the only cleaning necessary. Non-stick pans have been said to require less oil than conventional pans, thereby producing healthier food, but experienced cooks assert that one can cook on seasoned cast iron with as little oil as desired.

The one disadvantage of cast iron is that it requires some practice to use correctly, but that is a relatively minor inconvenience. The view that modern technologies, despite poorer cooking performance, are preferable to older technologies, which require some skill, has clearly won out in this case. Despite real worries about the safety of new technologies, companies would rather invent even newer technologies than support old technology that is certified as safe. While there is a fringe of people who appreciate old cooking technologies (discussing them, sometimes heatedly, in online forums), many people don't even notice that there is a choice. It's hard to tell whether most consumers actively embrace modern non-stick cookware over cast iron, or whether they have passively succumbed to the industry's push to profit from new technology.