

## Solutions For a Sustainable Future

### The Cattle Carcass Conundrum



As the U.S. population grows, so does the number of cattle, which in turn is giving rise to a waste disposal problem. The predominant cattle carcass recycling method is no longer available in this country, so billions of pounds of waste meat and bone have been classified as fit only for disposal, contributing to overburdened landfills. Now scientists at Clemson University have come up with a way to recycle at least part of the mess by converting cattle bone meal into bioplastic.

Until recently, cattle carcasses were routinely ground up and used to make food for domesticated animals, including pets. Then Mad Cow Disease happened in the U.K. The lethal disease can be spread by ingesting certain parts of infected cattle. In order to prevent mass infection in the U.S., the Food and Drug Administration classified certain cattle parts and whole carcasses of older cattle as “cattle material prohibited in animal feed.” As cattle herds cycle out of the age limit, the problem will diminish, but that still leaves a lot of ongoing waste, in addition to waste spikes that may arise if and when other diseases appear.

**Factoid: Many Pet foods still contain many products that although sound harmless, are potentially harmful to your pet. Not only meat renderings and by products**

**(consist of non-rendered clean parts of carcasses such as heads, feet, and viscera) but corn and grains and preservatives (ethoxyquin).**

Scientists are using a combination of meat and bone meal to engineer a bioplastic, using a process that has the added advantage of deactivating the infectious agent that causes bovine spongiform encephalopathy (Mad Cow Disease). They also found that the new bioplastic can be mixed with an ultra-durable form of polyethylene plastic, without significantly weakening the characteristics of the polyethylene. This gives rise to the possibility that one day in the future, high-durability products such as skis and snowboards may be some day include a bit of bone meal.

All things being equal, a material that is part bioplastic, part conventional plastic is not a particularly sustainable solution. However, as a transitional material, the new bone meal plastic can at least help reduce the need for petroleum feedstock to manufacture a wide variety of items, including ones that call for durability. Biodegradable car parts are on the rise, for example, not only from vegetable matter but also from at least animal-derived source, chicken feathers.

A Massachusetts Company is to develop a bioplastic for military use in food packaging. The logistics are compelling. Tons of plastic go into wrapping and shipping MRE's and base food supplies. Disposing of all that waste requires fuel, which in turn requires a convoy, and convoys need to be manned – and in some cases, defended. Cutting down on non-biodegradable waste is one way to trim costs and improve troop safety.

With the U.S. military throwing it's considerable weight behind a bioplastic that's not merely biodegradable but compostable, there's a chance for the economics of scale to kick in. One thing holding bioplastics back from the mass market is price, so once that barrier falls, anything is possible. Researchers are already working on a way to make car parts out of coconut husks, so using a compostable bioplastic doesn't stretch the imagination that much farther. For that matter, the U.S. military is also looking into recycling used bioplastic to make diesel fuel.

**Factoid: Biodegradability refers to the capability of a material to be converted into carbon dioxide by microorganisms. Compostability is held to a higher standard – a lot of them, in fact. In order to be considered compostable, a material has to meet standards for heavy metals and any other substance that could affect the plants that grow in it.**



Not to be outdone by Cattle Carcass Conundrom, the chickens are fighting back with useful solutions to their waste problem. Scientists have discovered a remarkable, unexpected and *cheap* way to store hydrogen fuel– using carbonized chicken feather fibers.

The problem of storing hydrogen as fuel has traditionally been a perplexing and expensive dilemma. For instance, a car with a 20-gallon hydrogen storage tank made from carbon nanotubes or metal hydrides– two of the best ideas so far– would add \$30k respectively to the price of that vehicle.

A storage tank made from carbonized chicken feathers, however, would only mark up the cost a measly \$200. The green bio-material would also help solve the problem of how to dispose of the 2.7 billion kilograms of chicken feathers generated each year by commercial poultry operations.

One of the major reasons hydrogen-powered vehicles aren't commonplace on our highways is the immensely difficult problem of how to store enough of the fuel on-board to give those vehicles a cruising range that approaches that of gasoline or diesel fuel. Storing sufficient quantities requires placing it under extreme pressure, which can add significant weight to the vehicle and increase the potential for a dangerous explosion.

That problem has led scientists to look toward structures like carbon nanotubes for a solution, since they can pack large quantities of hydrogen at normal pressure within a fairly small space. The catch is that manufacturing carbon nanotubes is very expensive and ultimately impractical.

While researching the potential of keratin derived from chicken feathers to improve the performance of microcircuits, Scientists unexpectedly discovered that by heating the keratin fibers they could strengthen its structure enough to compare to the strength of nanotubes. In other words, the hydrogen storage capacity of the strengthened keratin was essentially equivalent to that of carbon nanotubes, but using nothing more than chicken feathers as raw material.

In addition to hydrogen storage, the new method could turn chicken feather fibers into a number of other eco-products like hurricane resistant roofing, lightweight car parts, as well as the aforementioned bio-based computer circuit boards.

**Factoid: Previously, there has been no major use for all the feathers leftover from chickens in the poultry industry.**

I am Jim Steigner (Mr. Comfort) and I just wanted you to know. As always please feel free to contact me at [www.mrcomforthvac.com](http://www.mrcomforthvac.com), under the “Ask Mr. Comfort Section”.