Paving the Way for More Sustainable Roads: Anova® gets you there

How Green Chemistry Can Reduce Greenhouse Gas Emissions. Case Study for the GC3 Sustainable Chemistry Alliance.

Asphalt additives for a better tomorrow

As we look for more sustainable solutions in business operations, it's easy to focus on the more obvious practices like alternative energy use, water, ag practices and material waste. But many may not be familiar with how bio-industrial applications in less glamorous sectors of the economy, like road construction, can have major implications on reducing greenhouse gas emissions.

The Challenge

When you look at the scale and scope of the road construction industry, with more than 2.6 million miles of paved roads in the United States, it's an area that should be considered more often as part of a grand scale solution.

Industry research published by the International Journal of Sustainable Transportation, shows that keeping roads maintained could reduce carbon emissions from vehicles by up to 2 percent. These savings would more than offset the pollution that road construction generates. Plus, better-paved roads would cut transportation agency spending by 10 - 30 percent and would also save drivers 2 - 5 percent in fuel, tire wear, and repair and maintenance costs.

Yet, maintenance of our roadways is not keeping pace. According to the American Society of Civil Engineers, one out of every five miles of paved road in the U.S. is in poor condition and need of significant rehabilitation.

Next to this, there is a high amount of asphalt pavement waste generated from the milling of old pavements. According to current specifications, only a small amount can be reused and recycled as "Reclaimed Asphalt Pavement" (RAP). The rest gets stockpiled or downcycled into other lower value applications. This is especially an issue in high population density urban areas with large pavement systems in which large stockpiles of pavement millings are constantly accumulating. Low utility of such millings in new pavements means that a high amount of GHG-intensive virgin (new) construction material is used at large volumes for new construction.

And while more sustainable practices are catching on in various industries, the increase in recycled asphalt has seen a slow evolution. Concerns about performance at the federal, state and local levels have kept asphalt mix specs the same over many decades. That hesitation, regardless of proven results from RAP projects around the world for years, is not allowing the industry to adapt these innovative solutions, adding more waste, cost and unnecessary energy used to achieve a similar end result.

Existing Solutions

One solution to the above described issues is using a warm mix additive, like Cargill's Warm Mix Additive, which allows for the asphalt to be produced at a lower temperature (30-120 degrees Fahrenheit lower) while maintaining high performance. Compared to conventional hot mix asphalt, when operating at lower temperatures at the mix plant, it's estimated that $3.5 billion in savings is possible given less energy to produce asphalt mix. Using a warm mix additive also makes for a safer work environment for crews, because of the reduction of emissions and odor. **The estimated reduction of GHG emissions from production of Warm Mix Asphalt (WMA) at a reduced temperature can be up to 0.21 million tons (which is equivalent to the annual emissions of 46 passenger cars).**

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Another solution can be asphalt rejuvenators. Cargill's Anova Rejuvenator is an engineered additive based on renewable vegetable oils. Anova was designed for high chemical compatibility with aged asphalt and is functionally able to re-balance and "rejuvenate" specific asphalt chemical fractions degraded by aging and oxidation.

Rejuvenators are added at low dosages to the asphalt mix during production in an asphalt plant, along with increased reclaimed asphalt pavement (RAP). The result is a revitalized asphalt. By recycling, a 2018 industry report showed that some 62 million cubic yards of landfill space were saved.

A significant portion of the GHG contribution of asphalt materials comes from the production of the new raw materials, namely asphalt from a crude oil refinery and mineral aggregates from a quarry. This contribution, along with the fuel consumption of hauling this material from the source to the asphalt plant site, can be significantly offset by utilizing and recycling the milled material from the existing pavement in the form of RAP. Up to 100% of the new material has been successfully replaced with RAP using plant-based rejuvenators, saving huge amounts of GHG in the process.

In fact, a major industry survey conducted by the National Association of Paving and Asphalt (NAPA) in 2019 shows significant ways RAP is reducing environmental impact. **Their overall conclusion was that the use of RAP in new asphalt mixtures reduced greenhouse gas emissions in 2019 by 2.4 million metric tons of CO2e, which is equivalent to the annual emissions of 520,000 passenger vehicles.** This number takes into account all GHG emission reductions when using RAP, from reducing asphalt binder replacement to avoiding transport of virgin asphalt binder and aggregates to the plant, as well as the burdens of RAP - because RAP processing in itself emits GHG too. Meaning that the 2.4 million tons of CO2e paints a complete picture of the overall benefits of using RAP.

Additionally, if the U.S. increased average RAP use slightly, from 20% to 25%, it would deliver 600 million kg reduction of GHG, save $650 million in cost reductions and reduce energy use by 5.6 billion megajoules.

RAP applications have taken on even more urgency in 2020 given the significant reduction of gas tax revenue related to the COVID-19 pandemic. Less cars on the roads means less tax generation. Less tax revenue means road work will have to be delayed or canceled. However, as RAP allows road owners to pave more with less expensive and more environmentally friendly material, local communities, states and the country can do a better job of keeping up with our aging infrastructure.

What's more, recycled asphalt contributes to a circular supply chain and economic system. From supporting farmers producing a renewable, raw ingredient year-over-year, that then allows old aggregate to have a second life instead of going into a landfill, the circularity process creates a mutually beneficial outcome for multiple economies and long-term environmental benefits.

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