

Fully automatic cleaning process with solvents EFFICIENT, ENVIRONMENTALLY FRIENDLY, AND SAFE CLEANING OF TOOLING FOR COMPOSITE COMPONENTS

Composites such as CFRP are the key to lightweight construction in various industries. Cleaning the tooling used to manufacture these components is usually done manually with aggressive, environmentally harmful solvents. A well-known company in the aviation industry replaced this time-consuming and labourintensive manual cleaning process with an automatic cleaning system in a completely closed solvent cleaning unit that uses a modified alcohol. The result is not only higher quality and much shorter cleaning times, but also a significant reduction in the risk placed on employees and the environment.

The aviation and automotive industries are pioneers in using lightweight composite components such as carbon fibre reinforced plastic (CFRP). Today many other industries make use of this lightweight material to manufacture parts in series production – and this trend is steadily increasing. However, it has proven to be problematic to clean the tooling that produce these parts. This is usually done manually with brushes and large amounts of a low flashpoint solvent such as acetone. Beyond the fact that this type of cleaning takes a lot of time and effort and is also often insufficient for delicate or hard-to-reach areas, it places a significant challenge on employees and the environment.



Ultrasonics can be used at the same time as the filtration system with frequency-controlled regulated volume flow. Particles are thus carried out at the same time as cleaning, so they do not deposit in the work chamber

Cleaning solution based on comprehensive tests

This was also why a well-known company in the aviation industry sought an automated solution for cleaning these tools. Since there was no system of this kind on the market, the company turned to Ecoclean UK, a manufacturer of cleaning systems. Ecoclean partnered with chemical supplier SAFECHEM and conducted comprehensive tests at its own technology centre. At first, these tests focused on how to remove the impurities, which were comprised of curing agents, additives, and resin (some of which had been mixed with magnetic powder having a particle size of 40 to 50 micrometres). Also, it was naturally important to ensure that the tools, which were made of various steels, aluminium, copper, and nylon (some of which had a hard chrome plating), were not damaged in any way. Optimum results were achieved with the solvent DOWCLENE^{TM*} 1601.

This is a modified alcohol with lipophilic and hydrophilic properties. This combination enables both non-polar impurities like oil and resin as well as polar substances like salts to be removed from all tools in a reliable, reproducible manner. In addition, the tests proved that the impurities removed by the solvent could be subsequently removed by distillation and filtration. The solvent also has low toxicity and good biodegradability.

Fast cleaning designed for specific tooling

DOWCLENE^{TM*} 1601 is used in the solvent cleaning machine EcoCCore, which works under full vacuum. This means that a separate explosion prevention system is unnecessary. The cleaning machine is equipped with two tanks as a standard which enables pre-cleaning and fine cleaning operations. Vacuum drying, a built-in distillation system with heat recovery, and full flow filtration and bypass filtration for continuous solvent processing are other features of the standard design.

Cleaning tests also helped to determine the process design for the different tooling. Various process parameters like type, duration, and intensity of individual treatment steps were adjusted for each tool and saved as cleaning programmes in the system controls. The cycle times necessary for cleaning and drying various tools range from five to ten minutes, or fifteen minutes for extremely dirty parts. Cycle times are far under the 30-minute maximum cycle time requested by the customer, which results in higher productivity.

The EcoCCore's innovative process technology was a significant reason why this solution was chosen. This includes preliminary vapour degreasing, in which the used solvent is not routed into the flood tank as usual, but directly into the distillation system. This minimises dirt deposits in the tanks and counteracts the accumulation of waste in the solvent. In addition to the standard injection flood washing, the system is also equipped with ultrasonic. It can be used at the same time as the filtration system with frequency-controlled regulated volume flow. Particles are thus carried out at the same time as cleaning, so they do not deposit in the work chamber.



The SAFE-TAINERTM System supplies fresh DOWCLENE^{TM*} 1601 and stores used DOWCLENE^{TM*} 1601 for recycling. In combination with the closed cleaning machine, it represents the best available technology and prevents the operator from contact with the solvent.

Fully automatic process increases the protection for workers, health, and the environment

Ecoclean also provides automatic vehicles for transporting tools to and from the composite parts' production area. The trolleys are connected to the machine by mechanical and electrical locks. This solution takes the burden away from employees and prevents contamination of the work environment. Since the cleaning process is fully automated and the tooling can be removed in a dry state from the unit, employees are no longer exposed to solvent emissions. Due to the continual processing and closed-loop circulation, the amount of solvent used is significantly reduced and there are virtually zero emissions in the ambient air.

SAFECHEM'S SAFE-TAINERTM System supplies fresh DOWCLENE^{TM*} 1601 and stores used DOWCLENE^{TM*} 1601, which can then be taken back to recycling. This solution for safe transport, storage, and usage of solvents comprises two differently equipped, double-walled containers for new and used solvent. In combination with the closed cleaning unit, it represents the Best Available Technology (BAT).

The MAXICHECK[™] DCL-1N Test Kit is also utilised for monitoring the solvent stability. It contains everything needed for regular inspections. Any on-site stabilisation of the solvent can be achieved by simply and safely adding MAXIBOOST[™] or MAXISTAB[™] Stabilisers, effectively extending the life of the solvent and protecting the valuable tooling and equipment. In addition, SAFECHEM trains the employees at the aviation company responsible for cleaning in how to handle the solvents, legal compliance, and process reliability.

The company's investment in switching from manual cleaning of composite tools to fully automated EcoCcore processes was worth it because of the benefits to health and occupational safety as well as the environment and overall cost. *Author: Doris Schulz*



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The combination of an innovative solvent cleaning machine and a modified alcohol enable an automated, process relatable and fast cleaning process of the tooling for parts made of carbon fibre reinforced plastics (CFRP).

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Contacts:

Ecoclean UK Matt Cooper, Warwick, UK Telephone +44 7799 346611 matt.cooper@ecoclean-group.net

SAFECHEM Europe GmbH Richard Starkey Telephone +44 7976 531695 r.starkey@safechem.com