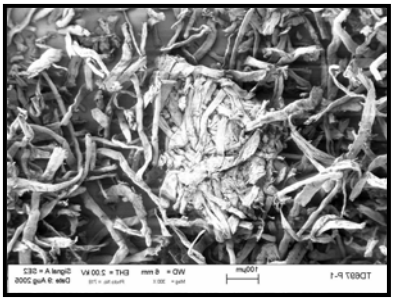
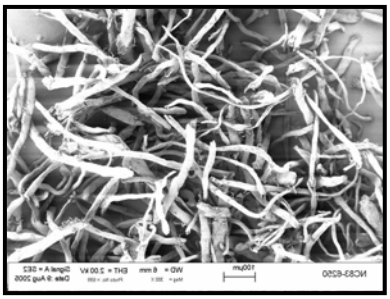
RFAAP NC Process Improvement Project – Shaping the Future of NC Production
By Mr. Dan McGlothlin
Radford Army Ammunition Plant (RFAAP) ACO Engineer

A current project underway at the RFAAP will allow the existing nitrocellulose (NC) manufacturing process to produce a product that will satisfy ever tighter quality and performance requirements. This project will also provide valuable data that will be used by the RFAAP Modernization Team in the design of a new NC facility which will be constructed at RFAAP in the near future.

NC is a base ingredient for virtually all propellants. RFAAP is the sole source of this NC within the North America Technical Industrial Base (NTIB), and has been operating since 1941. As the Global War on Terrorism (GWOT) continues, research and development on energetic products has resulted in more and more performance requirements being placed on these propellants and thus NC. Those increased requirements have resulted in the identification of agglomerates as a specific area of improvement. To understand agglomerates, one must first understand how NC is made. As an oversimplification, cellulose (wood pulp much like cardboard) is nitrated (mixed) with nitric and sulfuric acid. The resulting chemical reaction produces an energetic product. The agglomerates (also called nits or bundles) are dense masses or clumps of fibers that can sometimes be found in the cellulose material. Agglomerates resist the absorption of nitric and sulfuric acids during the nitration phase of the NC production process. They also resist absorption of solvents which are used in the production of certain propellants. The presence of agglomerates in the NC and the resulting incomplete absorption of the respective acids and solvents can contribute to variances in propellant performance.



NC agglomerate

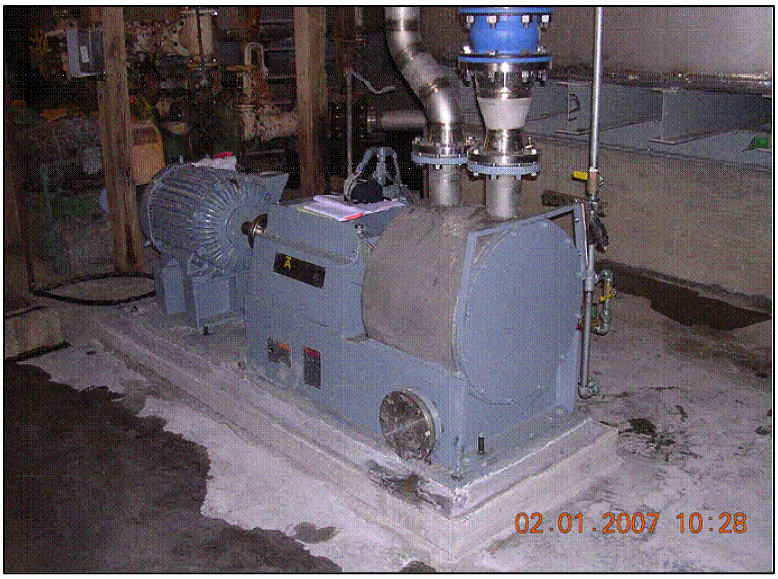


NC w/out agglomerate

The operating contractor at RFAAP, Alliant TechSystems (ATK), as well as US Government personnel from the Armament Research Development and Engineering Center (ARDEC) have been working closely with members of the NC manufacturing community to understand how agglomerates can be reduced. From these efforts they have identified new pieces of equipment that will soon be integrated into the current NC manufacturing process at RFAAP.

This first piece of equipment is a deflaker unit. In most cases (80-85%) wood pulp is the source for the cellulose fibers used to manufacture NC at RFAAP. As the NC is fed into the deflaker, it will pull apart the cellulose fibers and therefore the agglomerates. The number and size of agglomerates found in the wood pulp can vary depending on the source of the pulp. The deflaker will be accompanied by several

processing tanks and will be installed in an existing NC production building. The mechanical refining of the cellulose fibers by the deflaker will be in addition to that which is already used in the NC process. The goal is to maximize the number of individual cellulose fibers that leave the deflaker unit but not to the point of breaking the fibers apart into what is referred to as “fines” or undersized NC fibers which is undesirable.



Deflaker Unit (Courtesy ATK)

The second piece of equipment is a cutter. Uniformity, in both size and shape, of the cellulose material that is introduced into the beginning of the nitration process is a key aspect of producing quality NC. The cellulose material arrives at RFAAP by railcar in large rolls, similar to rolls of paper. Handled by fork lifts, these rolls are processed through a cutting machine which reduces the material into small chip shaped particles. A new cutting machine will replace an existing machine and will produce particles with more uniform characteristics and less dust. This change will lead to a more consistent material throughout each phase of the NC production process and therefore a more consistent end product. The new cutting machine is patented and marketed by Bowas-Induplan Chemie of Austria.

The NC that is produced now at RFAAP continues to meet all Military Specifications (MilSpec) despite the agglomerate issue and meets the majority of our customers needs. But, there continues to be an increased need for higher quality NC that actually exceeds the current MilSpec. These changes are being driven by advances in technology. Already,

Cellulose Cutter (Courtesy Bowas-Induplan Chemie)

European NC manufacturers operate modern facilities that produce high quality NC. With these new projects, RFAAP can meet those same demands and will be prepared to produce this higher quality NC in commercial quantities by FY 2010. These projects will also lay the ground work for a modern NC production facility at RFAAP that will be capable of providing the Warfighter of the future with superior propellants and energetic materials.