HISTORY OF AMMONIA TECHNOLOGY

1. Natural Ammonia Reacting With Natural Sugars

We can consider the history of ammonia technology to start with Columbus in 1492 when he discovered tobacco in the Americas.

Tobacco contains natural ammonia and sugars, which must certainly react. For example, we find small amounts of deoxyfructosazines in purchased flue-cured tobacco, and these compounds are formed by reaction between ammonia and the reducing sugars glucose and fructose.

2. Redrying Of Cased Burley Tobacco

Ammonia technology was enhanced when cased burley tobacco was redried to make pipe tobaccos. Casing and redrying greatly reduced the harshness of burley and slowed down its burn rate. The burley taste character was also changed markedly. This technology was later incorporated into the development of the so called American blended cigarette, which first appeared as Camel in 1913.

IN ANALYTICAL EXPERIENCE, WE CAN NEVER FIND THE SAME AMOUNT SUGAR WE ADDED IN THE FINAL CASED/REDRIED BURLEY TOBACCO. THE WEIGHT IS STILL THERE, BUT MUCH OF THE SUGAR HAS CHANGED SUCH THAT IT NO LONGER ANALYZES AS SUGAR. THIS ANALYTICAL LOSS OF SUGAR IS MUCH GREATER WHEN REDUCING SUGARS PREDOMINATE IN THE CASING. WHAT HAS HAPPENED IS THAT THE SUGARS HAVE REACTED WITH AMMONIA TO FORM DIFFERENT MATERIALS.

THE IMPORTANT POINT IN THIS HISTORY IS THAT AMMONIA TECHNOLOGY IS NOT NEW, AND THAT IN PRACTICING MORE ADVANCED AMMONIA TECHNOLOGY WE ARE NOT GENERATING ANYTHING NEW. WE SIMPLY ENHANCE WHAT WE HAVE HAD ALL THE TIME.

3. PHILIP MORRIS BAND-CAST RECONSTITUTED TOBACCO

RECONSTITUTED TOBACCO (RECON) MANUFACTURE WAS PIONEERED BY THE CIGAR MANUFACTURERS WHO NEEDED ECONOMICAL ALTERNATES TO LEAF FOR BINDERS AND WRAPPERS. THE MOST SUCCESSFUL METHOD WAS DEVELOPED BY THE GENERAL CIGAR CO. IT INVOLVED COOKING AND FINELY GRINDING A WATER SLURRY OF STEMS AND TOBACCO FINES, AND THEN CASTING IT ON A WIDE STAINLESS STEEL BELT WHICH CONVEYED IT THROUGH A DRYING TUNNEL. THE DRIED SHEET WAS DOCTORED OFF THE END OF THE BELT. THIS IS THE BAND-CAST PROCESS, SOMETIMES CALLED THE SLURRY PROCESS.

SOME NATURAL PECTIN IS RELEASED DURING THE GRINDING OF THE SLURRY, AND IT IS THIS PECTIN THAT HOLDS THE FINAL RECON SHEET TOGETHER. B&W'S RECON, PCL, ~~WITH~~ WHICH WAS MADE IN THIS

MANNER WITH NO FURTHER CHEMICAL TREATMENT OR ADDED BINDERS. IMASCO'S AJAX PROCESS PCL MADE THE SAME WAY, BUT SOMETIMES WITH A FOREIGN BINDER, SODIUM CARBOXYMETHYLCELLULOSE.

AT ABOUT THE SAME TIME IN THE EARLY 1950'S, PHILIP MORRIS (PM) WAS ALSO DEVELOPING A BAND-CAST RECON TO REALIZE THE ECONOMIES OF FULLY USING STEMS AND TOBACCO FINES. BUT, PM DECIDED TO FREE MOST OF THE PECTIN IN THE TOBACCO, THUS PRODUCE A ~~VERY~~ STRONGER SHEET. PECTIN RELEASE WAS ACCOMPLISHED BY COOKING THE SLURRY WITH DIAMMONIUM PHOSPHATE, AND ADDING MORE AMMONIA AS NECESSARY TO MAINTAIN EFFICIENT PECTIN RELEASING CONDITIONS. PM CALLED THIS SHEET RCB.

PM'S RCB SHEET DRAMATICALLY ALTERED THE SMOKE TASTE FROM TOBACCO BLENDS. THE TASTE CHARACTER WAS STRONGLY SHIFTED TOWARDS BURLEY WITH FURTHER ENHANCED BARNYARD NOTES. THUS, THE MARLBORO MAN WAS BORN IN A MASTERFUL ADVERTISING CAMPAIGN. BEFORE RCB, MARLBORO WAS A SLOWLY DECLINING BRAND THAT APPEALED MAINLY TO WOMEN. AFTER RCB, MARLBORO SALES SHIFTED TOWARDS STEADY GROWTH.

THE RCB RECON HAS ANOTHER INTERESTING PROPERTY. IN THE CIGARETTE IS SCAVENGES NICOTINE FROM THE OTHER TOBACCOS. RCB PICKED OUT OF CIGARETTES WILL HAVE THE HIGHEST NICOTINE CONTENT OF ANY BLEND COMPONENT, OFTEN BY A FACTOR OF TWO. BATCF HAVE INVESTIGATED THIS "AMMONIA EXCHANGE" REACTION. ALSO, A LORILLARD PATENT PROVIDES FULL DETAILS.

4. PM's Paper Recon

A paper process Recon is inherently cheaper to manufacture than a Band-Cast Recon. Small amounts of paper Recon first appeared in PM's brands in 1973. We understand that PM first had Kimberly-Clark Co. make the sheet for them, then bought the "know-how" and the process and built their own paper Recon factory. Over a period of several years the paper Recon steadily increased until it leveled off at about 70% of the Recon in PM's cigarette blends.

The presence of substantial paper Recon in PM's cigarette blends coincided with the explosive growth of their Marlboro brand. We can see why. In our judgement, RCB and B&W's comparable CPCL, are too much of a good thing.

At some point PM incorporated ammonia technology into their paper Recon process. This was done by adding diammonium phosphate to the mix. The important point is that PM has never been able to replace RCB with their cheaper paper Recon. This fact led to the conclusion at B&W that RCB is the "soul of Marlboro". Confirmation of this conclusion is provided by PM's wide use of RCB in worldwide markets.

Two recent changes in PM's paper Recon have been incorporation of urea (see later) for harshness reduction, and use of propyl paraben to retard mold growth.

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5. PM's Ammonium Carbonate Expanded Tobacco (ACET)

PM first started using ACET in the early 1970's. However, this expansion process has corrosion and other problems. ACET was phased out in the U.S. about December 1987. In the last stages of domestic ACET use, only PM's Louisville factory was making Marlboro with ACET; the Richmond and North Carolina factories were making Marlboro with DIET.

6. Related PM Information

It is our understanding that PM used ammonium carbonate in casings during the transition stage when ACET was being phased out.

PM is also using ammonium carbonate to facilitate nicotine release in denicotinizing tobacco for their new De-Nic brands. These all seem to use the same 100% flue-cured blend, but this blend ends up with twice the ammonia level of the Marlboro blend.

For many years we wondered about the wide spread between reducing sugars and total sugars in PM brands. We later found the explanation; PM cigarette blends have high sucrose levels. Sucrose is not a reducing sugar and shows little reactivity with ammonia.

THE IMPORTANCE OF SUCROSE CASING IS THAT THE AMMONIA IN PM'S RECONS MIGRATES TO THE TOBACCO WHERE IT REACTS WITH THE REDUCING SUGARS. SUCROSE REMAINS LARGELY UNAFFECTED TO DO ONE MAJOR THING WE EXPECT OF A SUGAR CASING, WHICH IS TO REDUCE THE pH OF BURLEY SMOKE TO PRODUCE AN ACCEPTABLE TASTE.

PM USES MOST OR ALL OF ITS BURLEY STEM IN ITS RECONS. ABOUT 1980 THEY CHANGED THE MANUFACTURING PROCESSES FOR BOTH RECONS TO REMOVE MOST OF THE NITRATE.

6. B&W UREA DEVELOPMENT

B&W OBTAINED A U.S. PATENT IN 1976 ON THE USE OF ADDED UREA TO MAKE A FLUE-CURED BLEND TASTE MORE LIKE AN AMERICAN BLEND. UREA WAS ALSO FOUND TO BE VERY EFFECTIVE IN REDUCING AT LEAST ONE TYPE OF HARSHNESS; IT "FIXED" THE CIGARETTE THAT WAS ACCEPTED AS THE WORLDWIDE MAXIMUM FOR HARSHNESS.

WHILE B&W DID NOT PURSUE THIS DEVELOPMENT FURTHER, CELANESE USED ABOUT 2% UREA IN THEIR CYTREL TOBACCO SUBSTITUTE TO REDUCE "PAPER TASTE". B&W WORK WITH SIMILAR TOBACCO SUBSTITUTES SHOWED UREA TO MARKEDLY IMPROVE THEIR SMOKE TASTE FROM AWFUL TO JUST BAD.

KIMBERLY-CLARK HAS ALSO PROPOSED A MIX OF UREA AND PALMITIC ACID FOR REDUCING THE HARSHNESS OF PAPER RECONS.

7. B&W Development of EBR

Ammonia technology generally involves forcing some ammonia chemistry, and this is most conveniently done during Recon manufacture. B&W's two ammonia technology Recons will be briefly defined here, and detailed in later sections of the handbook.

EBR development had the twofold objectives of making an ammonia technology Recon and removing nitrate. The stem side of the furnish is primarily burley stems and the extract from stem digestion is discarded. Diammonium phosphate is added in the concentrated extract liquor (CEL) from lamina fines extraction.

8. B&W Development of CPCL

The objective in CPCL development was to match PM's RCB in all important characteristics except for nitrate removal. This objective has been met. There still remain some lesser differences, such as much more licorice in RCB.

With the purchase of the Lanchester factory for CPCL production, B&W will now be in a position to fully optimize this important Recon product.

9. Development of EMERGE by BATCF

BATCF does not use any Recon. Instead they use high levels of stem made by the WTS process. EMERGE was developed as a stem casing additive. Initial formulations

CONTAINED AMMONIUM SALTS OF MALIC AND CITRIC ACIDS, ALONG WITH SOME NATURAL PLANT POLYSACCHARIDE GUM. LATER SAMPLES HAVE CONTAINED VARYING AMOUNTS OF PHOSPHATE.

10. ANSIRO DEVELOPMENT BY SOUZA CRUZ

SOUZA CRUZ IS LIKE BATCF IN THAT THEY USE HIGH WTS LEVELS AND NO RECON IN THEIR BLENDS.

5. OTHER BAT DEVELOPMENTS

EMERGE

ANSIRO

6. COMPETITION - U.S. MARKET

7. COMPETITION - PM WORLDWIDE

8. BIBLIOGRAPHY