

FY96-XXI-65
DEVELOPMENT OF RESINS FROM DGC'S 3-METHYLCATECHOL

CONTRACTOR: Dakota Gasification Company

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PARTICIPANTS

| <u>Sponsor</u> | <u>Cost Share</u> |
|-----------------------------|-------------------|
| Dakota Gasification Company | \$110,614 |
| ND Industrial Commission | <u>75,000</u> |
| Total | \$185,614 |

Project Schedule – 18 Months

Contract Date – 11/8/95
Start Date – 11/8/95
Completion Date – 6/1/97

Project Deliverables

Status Report - 6/1/96 ✓
Status Report - 12/1/96 ✓
Final Report - 10/27/97 ✓

OBJECTIVE / STATEMENT OF WORK

The primary objective of this project is to determine if 3-methylcatechol can be used in the synthesis of resorcinol-formaldehyde (RF), phenol-resorcinol-formaldehyde (PRF), or related resins. A goal of this project is to use 3-methylcatechol as a reactant in the manufacture of laminated wood products with enhanced glue-line (cured bond) flexibility and other benefits. The catechols including 3-methylcatechol and 4-methylcatechol can be produced or recovered from the liquid stream at DGC's Great Plains SynFuels Plant (See Project LMFS-94-18).

STATUS

Work in the following four areas was done:

- Literature Review - Information was obtained from the scientific and patent literature on resorcinol resins and resorcinol copolymers. This information was used to develop schemes for the use of 3-methylcatechol in the manufacture of resorcinol resins, polymers and glues.
- Synthesis - Reactivity testing of phenol, meta-cresol, catechol, 3-methylcatechol, and resorcinol with formaldehyde was done. Test specimens were produced using 3-methylcatechol to produce modified resins.
- Testing and Analysis - The modified resins were evaluated using Dynamic Mechanical Thermal Analysis.
- Wood Laminate Testing - Sample wood laminates were assembled using modified resins. The laminates were subjected to flexibility and shear testing.

The following conclusions were reached:

- 3-Methylcatechol reacts with formaldehyde to form a hydroxymethylated product.
- 3-Methylcatechol is less reactive toward formaldehyde than resorcinol, but more reactive than phenol.
- A modified commercial RF recipe was established substituting pre-reacted 3-methylcatechol (0 to 30%) for resorcinol.
- Laminated wood test specimens, containing up to 20% 3-methylcatechol, showed increased flexibility.
- In wet, cyclic delamination tests of resins on Douglas Fir, the 10% reacted- (3-methylcatechol) resorcinol resin met specification, while 20% and 30% resins did not.

The following recommendations were made:

- Synthesis procedures for production of RF and PRF modified resins should be optimized to maximize adhesiveness and minimize brittleness.
- Larger quantities of the modified resin should be produced to enable additional testing and to identify scale-up problems.
- Questions of economic and technical feasibility for commercial scale operations should be answered.