

## ABSTRACT

**Background:** Research inventories on the co-pyrolysis of major biomass components such as cellulose with amino acid materials is scarce in literature despite the fact that such studies are critical in understanding toxic product relations from high temperature cooking, combustion of bio-fuels, cigarette smoking and forest fires. This paper explores, quantitatively, the yields of heterocyclic nitrogenated molecular reaction products of grave mutagenetic concern from the co-pyrolysis of model biomass materials; tyrosine and cellulose. Research has established that heterocyclic amines such as isocyanates are mutagens as well precursors for asthma, and other respiratory disorders.

**Methods:** An equimassic mixture of tyrosine and cellulose ( $50 \pm 2$  mg) by weight were pyrolyzed in a tubular quartz reactor in flowing nitrogen at 1 atm. Besides, varying combinations of tyrosine and cellulose in the ratios 3:1 and 1:3 were also explored for comparison. The reaction time was set at 2 s so as to simulate combustions events in nature. The pyrolysate was collected over 5 mL dichloromethane and characterized using a gas chromatograph coupled to a mass spectrometer detector.

**Results:** Evidently, it was noted that 1-methylindazole was released in high yields at 300 °C, constituting ~ 300 µg in the entire pyrolysis temperature range (200-700 °C). Nonetheless, isoindazole gave the highest yield ~ 730 µg while 1-naphthyl isocyanate gave a total yield of ~ 336 µg in the same temperature range. Remarkably, the change in char yield between 300 and 450 °C for the pyrolysis of 25% tyrosine in 75% cellulose was found to be ~ 48% whereas the change in char yield for the pyrolysis of 75% tyrosine in 25% cellulose was 49%.

**Conclusion:** The char and tar yields considered important residues of biomass burning have been reported in this study and found to be consistent with other research output in literature. The striking similarities of % yield of char across all temperatures for various combinations was the most significant observation in this investigation-char yield was independent of the mixing ratio during pyrolysis. From a mechanistic standpoint, it was noted that tyrosine inhibited cellulose based nitrogenated products. Thus N-products dominated the O-products.

**Keywords:** 1-naphthyl isocyanate; Biomass materials; Heterocyclic amines; Mutagens.