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Pyrolysis as a Sustainable Waste Management Solution to Dispose Discarded Waste Tires**Piyathilaka A.¹, Ranaweera S.², Sewwandika N.³**¹*INOVA Environmental Services Pvt. Ltd, Kottawa, Sri Lanka*²*Department of Chemistry, University of Ruhuna, Sri Lanka*³*Department of Chemistry, University of Sri Jayewardenepura, Nugegoda, Sri Lanka***ayal.piyathilaka@inovaen.com***Abstract**

Due to the rapid growth of vehicle usage in Sri Lanka, the waste tire generation is increasing exponentially and has become a serious environmental and social issue. Landfilling and burning of tires in open environment are not sustainable waste management solutions for the disposal of waste tires. The burning of tires produce air pollutants such as carbon monoxide (CO), sulphur oxides (SO_x), nitrogen oxides (NO_x), poly-aromatic hydrocarbons (PAH) and other toxic congeners. These pollutants affect the human health causing skin rashes, eye irritation, respiratory problems and even cancers. As a sustainable waste management solution, pyrolysis can be recognized to dispose waste tires. Pyrolysis is a process of thermochemical decomposition of organic as well as inorganic material at elevated temperature in the absence of oxygen. The mechanism of pyrolysis process involves the molecular breakdown of larger molecules into smaller molecules. In the pyrolysis process, waste tires are used as a feedstock and heated up to 400-450° C in a closed reactor in absence of oxygen. During pyrolysis, waste tires are broken down in to smaller molecules such as pyrolysis oil (45-55%), pyrolysis gas (8-10%), carbon black (30-35%) and steel (10-15%). Pyrolytic gas can be used as a fuel source for domestic cooking purposes pyrolytic oil is suitable as an alternative fuel for various industrial applications due to its high net calorific value. Liquid fraction consists of xylene, toluene, styrene, and limonene. Pyrolytic char can be converted into carbon black by chemical and physical treatments Purified Carbon black can be used as a heating material or as a pigment in tire and plastic industry. Gaseous fraction mainly consists of a mixture of short chain hydrocarbons, and carbon monoxides/hydrogen mixture which is known as “syn gas”. Syngas is widely used a starting materials to produce gasoline. Syngas fraction consists of 11.21% of carbon dioxide, 26.82% of hydrogen 24.5% of methane 12.12% of ethane. CHNS analysis was completed using Perkin Elmer 2400 serious. CHNS analyses results confirmed that purified carbon black sample contain 78.31% of C, 1.36% of H, 0.55% of N and 2.57% of S. Metal oxides analysis was completed using Horiba scientific XGT 5200 X-ray analytical microscope. This confirmed that purified carbon black consist trace amount of Silica, Sulphur and Zinc. Particle size distribution was conducted using Malvern instruments master sizer 3000 particle size analyser. Particle size varies between 20 to 800 micrometers.

Keywords: Pyrolysis, Waste tires, Pyrolytic char and oil, Carbon black, Eco-friendly