

ABSTRACT

A microwave plasma biomass entrained flow gasifier comprising a gasifier body (8), a fuel inlet arranged at the lower part of the gasifier body (8), a synthetic gas outlet at the top part of the gasifier body (8), and a slag discharge outlet (10) at the bottom part of the gasifier body (8). Arranged outside the gasifier body (8) is a fuel preprocessing system, comprising a fuel crushing apparatus (1), a sieving apparatus (2) arranged downstream to the fuel crushing apparatus (1), a particle diameter-qualified fuel chamber (3) and a particle diameter-unqualified fuel chamber (4) arranged in parallel and downstream to the sieving apparatus (2), and a gasifier-front chamber arranged downstream to the particle diameter-qualified fuel chamber (3), where the gasifier-front chamber (5) is connected at the bottom part thereof to the gasifier body (8) via a burner. Arranged at the synthesis gas outlet (9) at the top part of the gasifier is a synthesis gas monitoring unit (12). Also provided is a process utilizing the gasifier for biomass entrained flow gasification. The process comprises: 1) a biomass fuel is preprocessed; 2) a microwave plasma working gas is introduced into a plasma generator, excited into plasma then injected into the gasifier; 3) biomass fuel powdery particles are injected into the gasifier via the burner, while at the same time, an oxidizer is fed into the system via an oxygen/steam inlet, injected into the gasifier simultaneously with the biomass fuel, the biomass fuel is subjected to a thermochemical reaction within the gasifier; 4) the temperature and content of the synthesis gas are monitored for implementing adjustments in oxygen flow rate, steam flow rate, and microwave power; the temperature at the synthesis gas outlet is between 900°C and 1200°C; finally, the synthesis gas is drawn out from the synthesis gas outlet at the top part, while at the same time a liquid slag is discharged via the slug discharge outlet.