

CLAIMS

1. A catalyst layer for proton exchange membrane fuel cells (PEMFCs), comprising:
5 a carbon support film comprising biochar derived from water hyacinth (*Eichhornia crassipes*),
a platinum catalyst integrated into the carbon support film,
and a polymeric binder.
- 10 2. The catalyst layer of claim 1, wherein the platinum catalyst is uniformly dispersed within the carbon support film and is present at a loading of about 0.1 mg/cm².
3. The catalyst layer of claim 1, wherein the polymeric binder
15 is polyvinylidene fluoride (PVDF).