**Supplemental Materials**

**Figure S1.** Biometabolites identified by GC-MS. AW=aqueous samples; NS=soil-attched samples: N2 present the biodegradation samples at the 14 day. (a)phenanthrene; (b) catechol; (c) dibenzothiophene; (d) 4-Carboxy-5-phenanthrenecarboxaldehyde; (e) cyclopentaphenanthren; (f) 4,4'-Bipyrimidine.
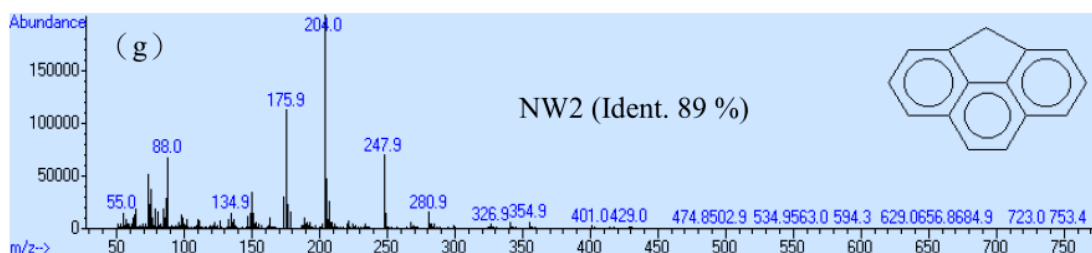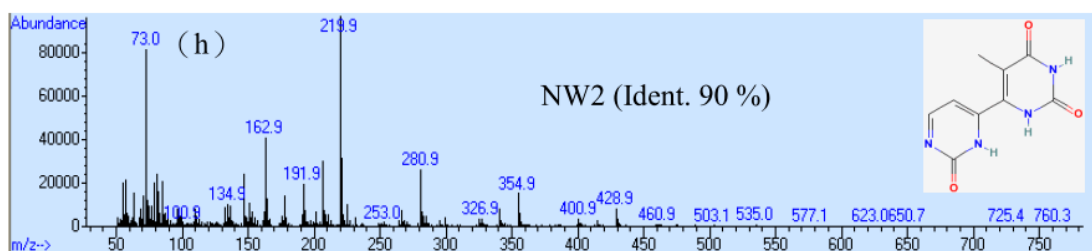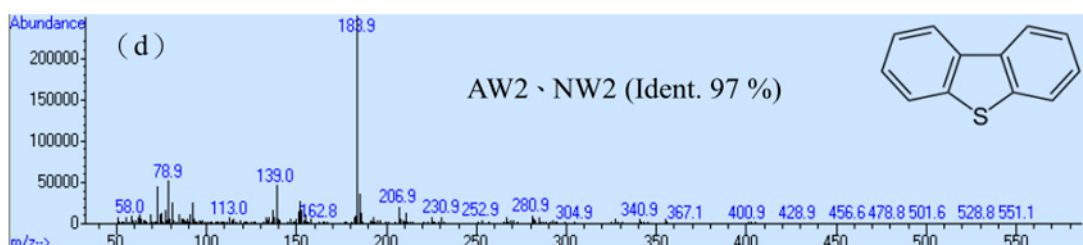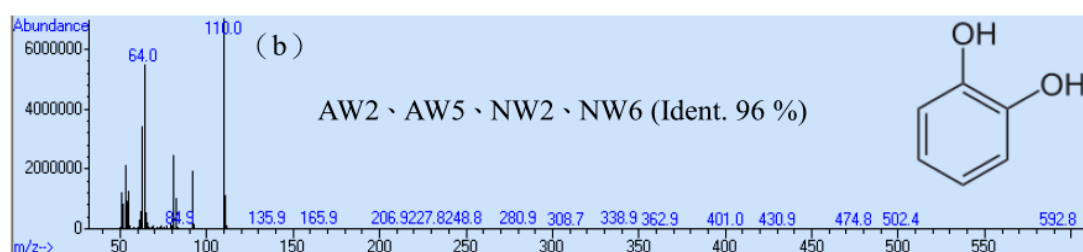
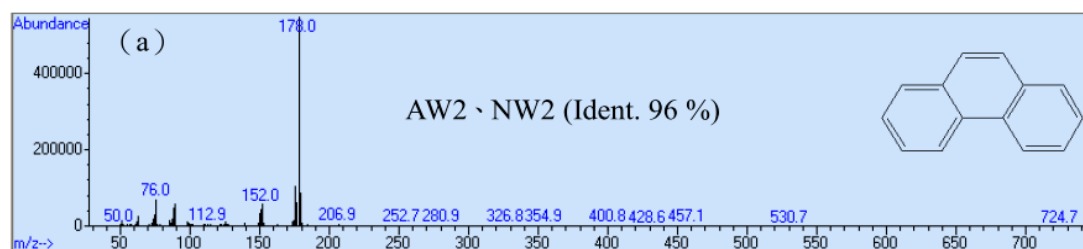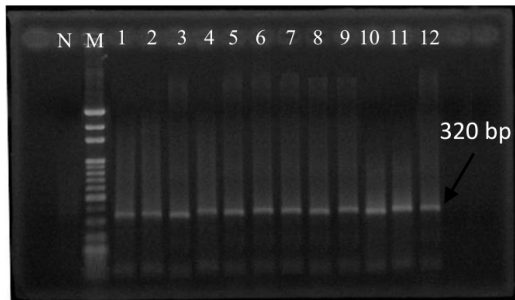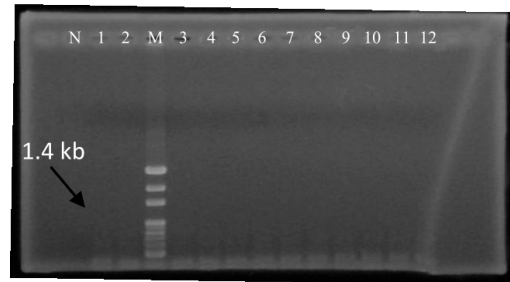**Figure S2.** Responses to dioxygeneses encoding target functional genes in PYR
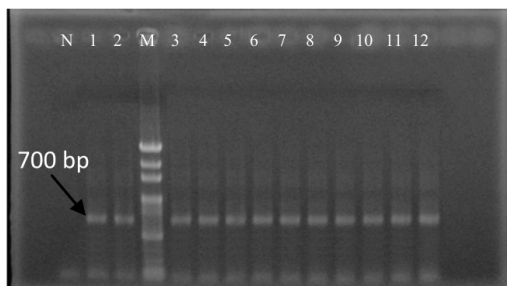
biodegradation in the ABR.

N：negative；1：chemostat N；2：N$_{2000}$；M：Marker；3：N0W、4：N0S、5：N2W、
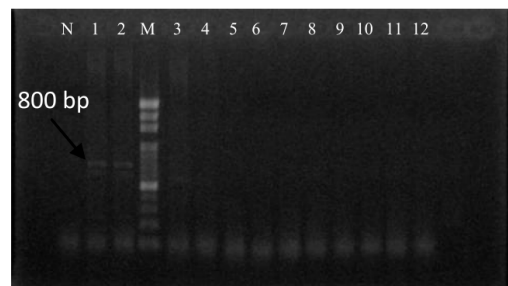6：N2S、7：N4W、8：N4S、9：N5W、10：N5S、11：N6W、12：N6S



Aromatic Ring-hydroxylating
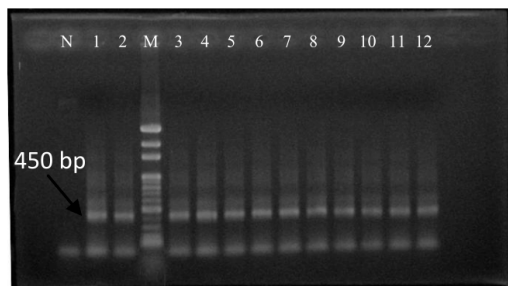dioxygenase (RHDα)

Naphthalene inducible
Pyrene dioxygenase gene (Nid A)



Rieske domain (Rf)

Protocatechuate (P34O)



Catechol 2,3-dioxygenase (C23O)