**1 Introduction**

Haloarchaea represents a distinct group of Archaea that typically inhabits hypersaline environments, such as salt lakes and sea salt pans. They are easy to culture and many haloarchaea are genetically tractable, hence they are excellent model systems for research of archaeal genetics, metabolism, and environmental adaptation. Furthermore, haloarchaea are capable of biosynthesis of extracellular polysaccharide, polyhydroxyalkanoates (PHA), bacteriorhodopsin, carotenoids and halophilic enzymes, etc., thus also have considerable biotechnological potentials. In the past a few years, we have systematically studied the carbon metabolism and PHA biosynthesis in haloarchaea, mainly with *Haloferax mediterranei* as a promising haloarchaeal cell factory (Fig. 1).

**2 Results and discussion**

The *H. mediterranei* is a metabolically versatile haloarchaeon, which is capable of biosynthesis of poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV), a desirable bioplastic among PHAs, from unrelated carbon sources including some inexpensive raw materials, like starch, extruded rice bran and whey. Therefore, we have shown great interests in the carbon metabolism of this haloarchaeon, including sugar transportation (Cai et al., 2014), chitin catabolism (Hou et al., 2013b), and especially, the PHBV biosynthesis pathway (Han et al., 2013) as well as the genome-wide regulation of PHA production (Liu et al., 2013). These studies were greatly facilitated by the availability of the genome sequences of the haloarchaea (Han et al., 2012; Liu et al., 2011b) and their highly efficient gene knockout systems (Liu et al., 2011a).

Briefly, we have demonstrated that *H. mediterranei* biosynthesizes PHBV from acetyl-CoA and propionyl-CoA via a three-step process catalyzed by β-ketothiolase (PhaA/BktB), β-ketoacyl-CoA reductase (PhaB1/PhaB2), and PHA synthase (PhaEC) sequentially, with novel enzymes we identified for the first time in haloarchaea (Table 1). Notably, the two β-ketothiolases (PhaA and BktB) with different substrate specificities are distinct in both subunit composition and catalytic residues from bacterial PhaA/BktB (Hou et al., 2013a). Two β-ketoacyl-CoA reductases, designated as PhaB1 and PhaB2 respectively, have also been identified to supply monomers for PHBV synthesis, of which PhaB2 is the major reductase (Feng et al., 2010). As for the PHA

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**Fig. 1.** An integrated view of carbon metabolism and PHBV biosynthesis in *Haloferax mediterranei.*

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homology with bacterial PhaPs (Cai et al., 2010b). In addition to the key enzymes, the PHA granule-production pathway and its assimilation of haloarchaea and also for the carbon cycling may have great physiological importance for the carbon cycling in hypersaline ecosystems.

...via multiple acetoacetyl CoA reductases and their function in different PHBV copolymer biosyntheses in Haloarcula hispanica. Saline Systems, 6: 9.

In addition, we have also developed an engineered H. mediterranei strain with an increase of approximately 20% in PHBV production (Zhao et al., 2013). Therefore, based on our elucidated PHBV biosynthesis pathway and its regulation, H. mediterranei has showed great potential to be engineered as a promising archaeal cell factory for future industrial production of PHBV.

**Key words:** haloarchaea, carbon metabolism, bioplastic production

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**References**


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