Development and Applications of Microbial Cell Surface Display

Jong Hyun Choi[1] and Sang Yup Lee[1, 2]

[1] BioProcess Engineering Research Center, [2]Metabolic and Biomolecular Engineering National Research Laboratory, Department of Chemical & Biomolecular Engineering, Center for Ultramicrochemical Process Systems and Bioinformatics Research Center, Department of BioSystems, Korea Advanced Institute of Science and Technology, 373-1 Guseong-dong, Yuseong-gu, Daejeon 305-701, Republic of Korea

Cell surface display allows peptides and proteins to be displayed on the surface of microbial cells by fusing them with the anchoring motifs, usually cell surface proteins or their fragments. The surface protein to be used as an anchoring motif should possess an efficient signal sequence for facilitating the translocation of a foreign protein through the inner membrane of the cell, a targeting signal for anchoring foreign protein to the surface of the cell in a stable manner, and a capability of accommodating foreign proteins or peptides of various sizes. Furthermore, it would be beneficial if the fusion protein can be expressed in large amounts. Depending on the characteristics of carrier and passenger proteins, C-terminal fusion, N- terminal fusion, or sandwich fusion strategy can be considered. As reviewed in Lee *et al.*(1), microbial cell surface display can be used for a wide range of biotechnological and industrial applications (Figure 1) such as: (a) live vaccine development by exposing heterologous epitopes on bacterial cells; (b) screening displayed peptide libraries by sequential binding and elution; (c) antibody production by expressing surface antigens; (d) bioadsorbents by displaying peptides/proteins capable of adsorbing chemicals and metals; (e) whole cell biocatalysts by immobilizing enzymes for the bioconversion; (f) biosensor development to anchor enzymes, receptors, or other signal-sensitive components on cell surface to develop novel biosensors for diagnostic and environmental purposes.

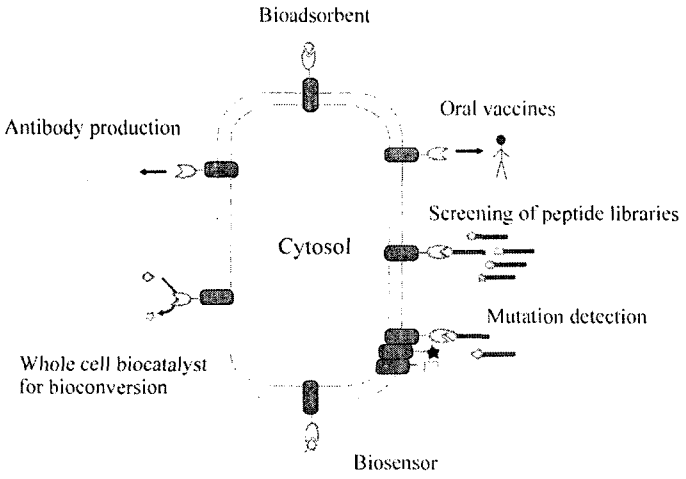

Fig. 1. Applications of cell surface display (taken from ref 1)

In this talk, I report the results on the development a novel cell surface display system using the OmpC as an anchoring motif in *E. coli*. We have recently reported successful sandwich fusion display of polyhistidine (poly-(6His)) peptides of varying sizes on the surface of *Escherichia coli* by using the *E. coli* outer membrane protein C (OmpC) as an anchoring motif (2, 3). Even though poly-(6His) peptide of up to 162 amino acids could be displayed using this sandwich fusion system, attempts to display larger polypeptide or enzyme were not successful. Therefore, we developed an alternative cell surface display system which allows expression and display of foreign polypeptides/proteins of larger sizes. A C-terminal deletion-fusion strategy was employed to fuse the polyhistidine peptides to the C-terminal of the functional portion of OmpC. The polyhistidine peptides of up to 243 amino acids could be successfully displayed on the *E. coli* cell surface, which allowed recombinant *E. coli* to adsorb up to 34.2 μmol of Cd^{2+} per gram dry cell weight. Other proteins to be exposed on the cell surface of *E. coli* have the high activities. Surface display of proteins or enzymes could be a powerful tool in biotechnological applications. [This work was supported by the National Research Laboratory program of the Ministry of Science and Technology, the Basic Industrial Research Program of the Korean Ministry of Commerce, Industry and Energy, and by the Center for Ultrami-crochemical Process Systems (CUPS)].

References

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