



ELSEVIER

Contents lists available at ScienceDirect

## Data in Brief

journal homepage: [www.elsevier.com/locate/dib](http://www.elsevier.com/locate/dib)

## Data Article

## Data in support of intermolecular interactions at early stage of protein/detergent particle association induced by salt/polyethylene glycol mixtures

Takayuki Odahara<sup>a,\*</sup>, Koji Odahara<sup>b</sup><sup>a</sup> National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba Central-6, 1-1 Higashi, Tsukuba, Ibaraki 305-8566, Japan<sup>b</sup> Fukuoka Agriculture and Forestry Research Center, Chikusion, Fukuoka 818-8549, Japan

## ARTICLE INFO

## Article history:

Received 16 December 2015

Received in revised form

28 March 2016

Accepted 1 April 2016

Available online 8 April 2016

## Keywords:

Integral membrane protein

Phase separation

Polyethylene glycol

Salt

Stability

## ABSTRACT

The data provide information in support of the research article, “Intermolecular interactions at early stage of protein/detergent particle association induced by salt/polyethylene glycol mixtures” [1]. The data regarding variation of absorption spectra is used as an indicator of the duration of *Rp. viridis* PRU and RC, *Rb. sphaeroides* RC and LH2, and *Rb. capsulatus* LH2 in the native state in the presence of NaCl/polyethylene glycol (PEG) mixture. The data about minimum concentrations of salt and PEG whose aqueous phases are mutually separated presents information on additional influence of Tris buffer and N-octyl- $\beta$ -D-glucoside on the salt-PEG phase separation.

© 2016 Published by Elsevier Inc. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

## Specifications table

Subject area	Biophysics
More specific subject area	Association of protein/detergent particles by salt/PEG mixtures
Type of data	Figure

DOI of original article: <http://dx.doi.org/10.1016/j.pep.2015.12.009>

\* Corresponding author.

E-mail address: [odahara-takayuki@aist.go.jp](mailto:odahara-takayuki@aist.go.jp) (T. Odahara).<http://dx.doi.org/10.1016/j.dib.2016.04.003>2352-3409/© 2016 Published by Elsevier Inc. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

How data was acquired	Absorption spectroscopy for protein stability, and observation with eyes for salt/PEG phase separation
Data format	Scaled intensity data for absorption spectra, and raw data for salt/PEG phase separation
Experimental factors	Wild-type photosynthetic bacteria were obtained from ATCC. Chemicals employed were high-grade ones; polyethylene glycol 4000 for gas chromatography was purchased from MERCK, NaCl and Tris(hydroxymethyl)amino-methane for biochemical assay from Wako, N-octyl- $\beta$ -D-glucoside and N-dodecyl- $\beta$ -D-maltoside from DOJINDO, and N,N-dimethyldodecylamine N-oxide from SIGMA
Experimental features	Absorption spectra were measured at various time points after NaCl/PEG mixture addition. Minimum concentrations for immiscible aqueous phases of salt and PEG were determined in the presence of 25 mM Tris buffer and 8 mg/mL OG.
Data source location	Tsukuba, Japan
Data accessibility	Data are available in this article.

## Value of the data

- Protein stability is a significant factor for determination of measurement time points after precipitant addition in the study of association of proteins in the native states.
- Protein stability will also provide basic information for the study of denaturation process of proteins caused by salt/PEG mixtures.
- Influence of buffer and detergent on salt-PEG phase separation is basic information to avoid the undesired influence on the association of integral membrane proteins.

## 1. Data

In this data article, data are shared regarding protein stability and salt-polyethylene glycol (PEG) phase separation. The former is absorption spectra of *Rp. viridis* PRU [2,3] and RC, *Rb. sphaeroides* RC [4,5] and LH2, and *Rb. capsulatus* LH2 measured at different time points after addition of NaCl/PEG mixture. The latter is shown as minimum concentrations of salts and PEG that form immiscible aqueous phases [6] in the presence of 25 mM Tris buffer and 8 mg/mL N-octyl- $\beta$ -D-glucoside.

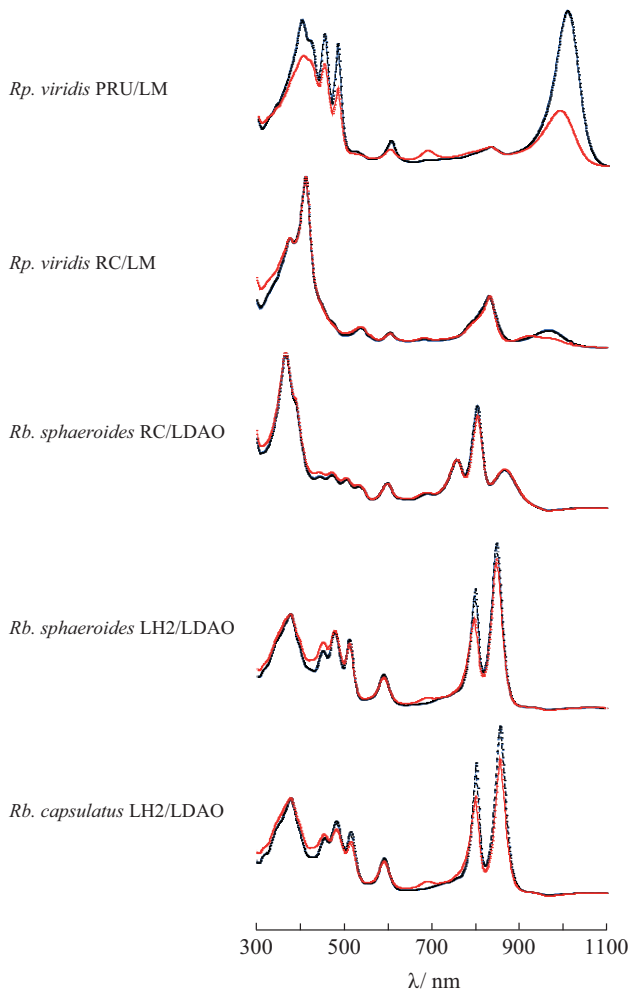
## 2. Experimental design, materials and methods

### 2.1. Stability of integral membrane proteins in the presence of NaCl/polyethylene glycol mixture

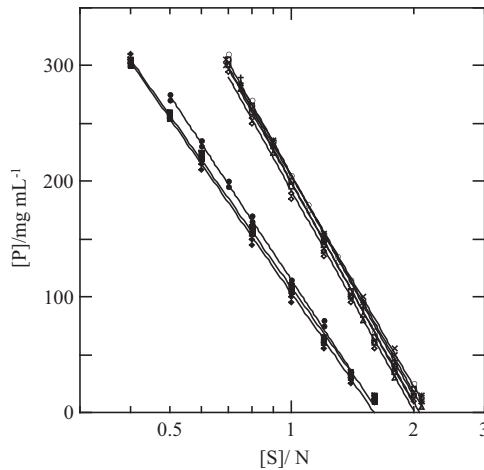
Fig. 1 shows representatives of the spectra measured at various time points after the addition of NaCl/PEG mixture. At one hour or shorter time points after the mixture addition, no variations in the spectra were observed for all the proteins. After several to 30 days, however, four proteins excluding *Rb. sphaeroides* RC exhibited variation in their absorption spectra that reflected variation of the intramolecular cofactors and the peptides supporting them. With *Rp. viridis* PRU, the absorption band with a maximum at 1006 nm, arising from bacteriochlorophyll in the LH1 subunits, decreased and a new peak appeared at 687 nm. In the spectra of *Rp. viridis* RC, the absorption band with a maximum at 830 nm, arising from special pair of bacteriochlorophyll, disappeared. With *Rb. sphaeroides* LH2 and *Rb. capsulatus* LH2, the two absorption peaks at 800 nm and 850 nm decreased and a small peak appeared at 690 nm.

## 2.2. Influence of Tris buffer and *N*-octyl- $\beta$ -*D*-glucoside on phase separation of salt and polyethylene glycol

Minimum PEG concentrations for phase separation at various salt concentrations were determined in the presence of 25 mM Tris buffer and 8 mg/mL OG, as follows. A concentrated salt solution, a 625 mg/mL PEG solution, a 400 mM Tris-HCl solution (pH 8.0), a 200 mg/mL OG solution and pure water were put in small glass tubes at different ratios, and the mixture was shaken vigorously on a vortex mixer. Formation of mutually immiscible phases was judged by observing with eyes whether the resultant mixtures were turbid. The result is shown in Fig. 2. Two symbols at each salt concentration in the figure represent the



**Fig. 1.** Absorption spectra of integral membrane proteins from photosynthetic bacteria stored at 20 °C in darkness in the presence of NaCl/PEG mixture. The examined proteins were *Rp. viridis* PRU and RC, *Rb. sphaeroides* RC and LH2, and *Rb. capsulatus* LH2. The spectra of each protein were measured for the purified sample (blue line) and the supernatants within 1 h (black dotted line) and in 14–35 days (red line) after the mixture addition. The longer duration was 14, 15, 21, 35 and 28 days for *Rp. viridis* PRU and RC, *Rb. sphaeroides* RC and LH2, and *Rb. capsulatus* LH2, respectively. The spectra were measured for protein solutions diluted by detergent-containing buffer solution (25 mM Tris-HCl and 300 mM NaCl; pH 8.0) of which the maximum absorbance was below 2. The spectra exhibited were scaled so as to fit their base lines to one another. The PEG concentration in the original supernatant was 62.5 mg/mL for *Rp. viridis* PRU/LM, 70 mg/mL for *Rp. viridis* RC/LM, 160 mg/mL for *Rb. sphaeroides* RC/LDAO, 150 mg/mL for *Rb. sphaeroides* LH2/LDAO, and 150 mg/mL for *Rb. capsulatus* LH2/LDAO. The concentration of LM and LDAO was 1 mg/mL.



**Fig. 2.** Minimum PEG concentrations at various salt concentrations for the formation of immiscible salt- and PEG-aqueous phases in the presence of 25 mM Tris buffer and 8 mg/mL OG at room temperature (21–24 °C). The salts examined were dipotassium tartrate, di-potassium hydrogen phosphate, and tri-potassium citrate. The solution ingredients were potassium tartrate in water ( $\circ$ ), 25 mM Tris-HCl ( $\square$ ) and 25 mM Tris-HCl and 8 mg/mL OG ( $\diamond$ ),  $K_2HPO_4$  in water ( $\bullet$ ), 25 mM Tris-HCl ( $\blacksquare$ ) and 25 mM Tris-HCl and 8 mg/mL OG ( $\blacklozenge$ ), and potassium citrate in water ( $\times$ ), 25 mM Tris-HCl ( $+$ ) and 25 mM Tris-HCl and 8 mg/mL OG ( $\Delta$ ).

highest PEG concentration where clear (single-phase) solutions were formed and the lowest PEG concentration where turbid solutions (containing two immiscible phases) were formed. The true minimum PEG concentrations for the phase separation should be of values between the two PEG concentrations. With each of the three salts, the minimum PEG concentration [P] varied linearly against the logarithm of the salt concentration [S]. Hence, the [P]–[S] line for each salt was calculated by least-square fitting of the relationship,  $[P] = A_{ps} - B_{ps} \log [S]$ , to the two PEG concentrations at various salt concentrations, where  $A_{ps}$  and  $B_{ps}$  were constants. The addition of Tris-HCl and OG exhibited an effect to lower the minimum PEG concentrations by 20 mg/mL at maximum. This effect was approximately similar to or less than the effect of the three salts at 25 mN.

## Acknowledgements

We are grateful to Dr. T. Shimizu of AIST for his constructive criticism on the manuscript. We thank Dr. Y. Abe of the Lion Corporation for the gift of purified LDAO.

## Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.dib.2016.04.003>.

## References

- [1] T. Odahara, K. Odahara, Intermolecular interactions at early stage of protein/detergent particle association induced by salt/polyethylene glycol mixtures, *Protein Expr. Purif.* (2016) 72–86.
- [2] T. Odahara, Stability and solubility of integral membrane proteins from photosynthetic bacteria solubilized in different detergents, *Biochim. Biophys. Acta* 2004 (1660) 80–92.
- [3] T. Odahara, N. Ishii, A. Ooishi, S. Honda, H. Uedaira, M. Hara, J. Miyake, Thermostability of *Rhodospseudomonas viridis* and *Rhodospirillum rubrum* chromatophores reflecting physiological conditions, *Biochim. Biophys. Acta* 2011 (1660) 1645–1653.

- [4] M. Ishimura, S. Honda, H. Uedaira, T. Odahara, J. Miyake, Thermal denaturation of photosynthetic membrane proteins from *Rhodobacter sphaeroides*, *Thermochim. Acta* 266 (1995) 355–364.
- [5] A.V. Hunghe, P. Rees, P. Heathcote, M.R. Jones, Kinetics analysis of the thermal stability of the photosynthetic reaction center from *Rhodobacter sphaeroides*, *Biophys. J.* 90 (2006) 4155–4166.
- [6] S.A. Oelmeier, F. Dismar, J. Hubbuch, Molecular dynamics simulations on aqueous two-phase systems – single PEG-molecules in solution, *BMC Biophys.* 5 (2012).