Accumulation of Selenium in *Candida utilis* Growing in Media of Increasing Concentration of this Element

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Received: 23 December 2019; Accepted: 18 February 2020; Published: 20 February 2020

**Abstract:** Selenium is considered an essential component of all living organisms. Studies on the enrichment of yeast cells with selenium, using the ability of cell biomass to bind this element, are being reported more and more. Yeast cultures were cultivated in YPD medium enriched with Na2SeO3 salts for 72 h at 28 °C on a shaker utilizing reciprocating motion. Selenium in cell biomass was determined with the use of ICP–MS. It was observed that the addition of selenium to the experimental medium (in the range of 4–100 mg/L) increased the content of this element in the yeast cell biomass. During the extension of cultivation time, the number of yeast cells and biomass yield exhibited a decreasing trend. Based on the obtained results, it was concluded that yeast cells exhibited the ability to accumulate selenium in both logarithmic and stationary growth phases. The dose of 20 and 30 mg/L of selenium in the culture medium meets the expectations in terms of both the content of selenium bound to yeast cells (1944 ± 110.8 μg/g dry weight) under 48-h cultivation. The obtained results confirmed that the *Candida utilis* ATCC 9950 strain exhibits the ability to bind selenium, which means that the biomass of these yeasts may be used as a natural source of selenium in the diet of humans and animals.

**Keywords:** selenium; bioaccumulation; *Candida utilis*; yeast; ICP–MS

1. Introduction

Selenium is an essential mineral for the proper functioning of cellular and body metabolism [1]. Selenium is a component of many enzymes, and also some proteins. Therefore, it also has an enzymatic and stabilizing function. Selenium prevents vascular diseases, stimulates the immune system and exhibits antiproliferative activity [2–4]. Selenium plays a role in optimizing thyroid function [5]. Selenium is an element found in many enzymes, especially those with antioxidant activity: glutathione peroxidase (GPx), iodothyronine deiodinase (DIO) and thioredoxin reductase (TRxR). These enzymes prevent the formation of hydrogen peroxide and the peroxidation of phospholipid cell membranes [6,7].

A great advantage of enriching yeast cell biomass with selenium is its high absorption from the gastrointestinal tract in humans and animals [8]. Traces of selenium are essential for animals and humans; however, the tradeoff between the necessary and harmful doses should be investigated [9]. The World Health Organization recommends a daily dose of selenium in an amount of 40 μg for an adult, emphasizing that a dose of 400 μg/d of selenium is safe. The increasing incidence of selenium deficiency in humans and animals has drawn attention to the yeasts whose cell biomass can be enriched with selenium so that it can be a natural carrier of this element [1,10].

Due to the ability of yeasts to permanently incorporate macronutrients and trace elements into the structure of their cells, they have become a source of not only protein but also of microelements
for humans and animals. In addition, the body absorbs these elements more efficiently in organic form than in mineral preparations [2,11]. Yeasts also exhibit decreased toxicity and increased efficacy in the treatment of deficiency of this element. Nowadays, when developing selenium-enriched products attention is being paid to the ability of yeast cells to bioaccumulate trace elements.

Most often, selenium occurs in combination with the amino acids cysteine and methionine (selenocysteine, selenomethionine). The most favorable form of selenium for humans is selenomethionine [12–14]. SeMet has antioxidant properties, improves the body’s resistance and stimulates the action of DNA repair enzymes. It should be emphasized that organic selenium compounds are absorbed at around 90%–95%, while inorganic compounds at a lower level [1,15]. Selenomethionine has the ability to be assimilated into proteins in place of methionine. The degree of utilization by the human organism of selenium originating from selenium yeast is estimated to be between 75% and 90% [16]. Few publications [1,17,18] indicate that yeasts are able to bind large amounts of selenium (up to 5000 μg/g dry weight).

Due to their ability to accumulate different elements in their cellular structures, yeasts are a convenient experimental model. They are characterized by high protein content and rapid growth, which is reflected in an intense increase in cell biomass. Collection of selenium in yeast occurs with the use of extracellular ligands of membrane assembly and intracellular accumulation resulting from the transport of this element across the cytoplasmic membrane into the cell interior [19,20]. Selenium accumulated by yeasts may occur in the organic form, e.g., selenomethionine, or in the form of red elemental selenium.

There are very few studies in the available literature on the accumulation of selenium by cell biomass of fodder yeasts, hence it is possible to use Candida utilis biomass as a source of this element in the production of food supplements or fodder additives. The objective of this study was to evaluate the possibility of intracellular binding of selenium by Candida utilis ATCC 9950 yeast in media supplemented with selenium in the range of 4–100 mg/L, and to determine the content of protein in yeast biomass.

2. Materials and Methods

2.1. Biological Material

Candida utilis ATCC 9950 was obtained from the Department of Food Biotechnology and Microbiology, Warsaw University of Life Sciences. The strain used was maintained at 4 °C on YPD agar medium (2% glucose, 2% peptone, 1% yeast extract).

2.2. Microbiological Media

For the preparation of culture media and selenium solutions, deionized water was filtered with the use of the Milli Q system (Millipore, France). Active acidity of the media was set at 5.0. Media and aqueous solutions of selenium Na2SeO3 salt were sterilized at 121 °C for 20 min. For submerged yeast cultures, sterile liquid YPD media were supplemented with a sterile Na2SeO3 solution (1000 mg Se⁴+/L) to obtain final selenium concentrations ranging from 4 to 100 mg/L. The control media were prepared in a similar way but without added Se salt.

2.3. Preparation of Inoculum

Inoculation cultures of Candida utilis ATCC 9950 yeasts were carried out in a flat-bottomed spherical flask containing 90 mL of liquid YPD medium. The inoculum was prepared by inoculation of liquid YPD medium with the 24-h culture of yeast strain collected from a slant with the inoculation loop. Cultures were grown on a reciprocating shaker SM-30 Control (Edmund Bühler GmbH, Bodelshausen, Germany) at the amplitude of vibration of 200 cycles/minute at 28 °C. Inoculation cultures were grown until termination of the logarithmic growth phase (24 h, the late exponential growth phase) until the largest number of yeast cells (4.0–5.0 × 10⁸ cfu/mL) was obtained. The resulting inoculum was used to inoculate liquid control and experimental media in a given test series.
2.4. Cultures of Yeast with Shaking

Cultures were shaken and grown in a flat-bottomed spherical flask with a volume of 500 mL containing 90 mL of control or experimental liquid medium. In order to inoculate media, 10 mL of a suspension of propagated cells in the inoculation culture (4.0–5.0 × 10⁸ cfu/mL) was used. Cultures were grown for 72 h under the same parameters as were used for the inoculation culture.

2.5. Determination of the Number of Cells

The number of yeast cells was determined by plate count method on YPD medium with 2% agar, culturing from subsequent 10-fold dilutions during 72 h submerged culture in the control and experimental media.

2.6. Determination of the Total Protein Content

The analysis of the total protein content in yeast cell biomass was carried out using the Kjeldahl method (Büchi mineralization and distillation units, Büchi Labourtechnik, Switzerland) [21]. A factor of 6.25 was used to convert the nitrogen value into protein.

2.7. Determination of Selenium Content in the Biomass of the Yeast Cells

Selenium content was determined directly after inoculation of the experimental media and after 24, 48 and 72 h of growth in submerged culture. The collected samples, with a volume of 30 mL, were centrifuged (3000× g, 10 min, 4 °C) followed by decantation of the supernatant. The resulting biomass was washed twice with deionized water followed by further centrifugation. The biomass was dried at 80 °C for 24 h until a dry weight was obtained.

Dried cell biomass (0.1 g) was mineralized in 5 mL of 65% nitric acid. After mineralization, the samples were diluted to 20–25 mL. The wet mineralization process was carried out in a microwave mineralizator (Multiwave Anton Paar, Austria) using Teflon bombs (Anton Paar, Austria). Determination of the total content of selenium (as Se⁸² isotope) was performed using a quadrupole mass spectrometer coupled with inductively coupled plasma-mass spectrometry (ICP–MS) (Elan 6100 DRC Perkin Elmer Sciex, Canada) (Table 1).

Table 1. Parameters in the determination of selenium with the use of ICP–MS.

| Parameter                  | Characteristics                  |
|----------------------------|----------------------------------|
| Spraychamber               | Quartz of Scott type             |
| Nebulizer                  | Meinhardtta concentric nebulizer |
| Plasma torch               | Quartz                           |
| Skimmers                   | Nickel                           |
| Generator rate             | 40 MHz                           |
| Generator power            | 1100 W                           |
| Plasma gas flow            | 15.00 L/min                      |
| Auxiliary gas flow         | 1.20 L/min                       |
| Nebulizer gas flow         | 1.00 L/min                       |
| Resolution                 | 0.7 ± 0.1 u                      |
| Dwell time                 | 100 ms                           |
| Scan rate                  | 20                               |
| Number of repetitions      | 3                                |
| Injection speed            | 1 mL/min                         |

External calibration using external standards was performed using 1% nitric acid. As an internal standard, the yttrium solution at a concentration of 10 μg/L was used. The ICP–MS method allows the determination of the total concentration of the selected element, that is, the total concentration of all forms of the element occurring in the solution tested [22]. The limit of detection and quantification
was 0.18 μg/kg and 0.37 μg/kg, respectively, in the procedure for the determination of selenium using ICP–MS.

The selenium concentration was determined using selenium-enriched yeast, a certified reference material SELM-1 with a certified concentration of selenium: 2059 ± 64 mg/kg (National Research Council Canada (NRC-CNRC)).

2.8. Statistical Analysis

The results obtained were subjected to analysis of variance using the Statistica 13.3 program (StatSoft Inc., Tulsa, OK, USA). The significance of differences between mean values in each group was tested by Tukey’s HSD test at a significance level $\alpha = 0.05$. Statistically homologous groups were marked in tables with the same letter.

3. Results and Discussion

3.1. Effect of Selenium on the Number of Yeast Cells

Immediately after the introduction of inoculum, the number of *C. utilis* ATCC 9950 yeast was $4.0–4.9 \times 10^7$ cfu/mL (Figure 1). After 24 h, their number in the control culture increased to $6.1 \times 10^8$ cfu/mL. In the media supplemented with selenium, budding of yeast cells in the log phase was significantly reduced. The literature data presented by Kitijama et al. [23] and Brozmanová et al. [24] indicate that the inhibitory effect of selenium on yeast cells results from changes in the composition and potential occurring in the cell membranes. The results of the study presented by Pescuma [25] also confirmed the inhibitory effect of selenium on *Lactobacillus* growth.

![Figure 1. Changes in the number of *C. utilis* yeast cells (Log cfu/mL) after cultivation in the control (YPD) and in the experimental media enriched with selenium in the form of Na2SeO3.](image)

The lowest dose of selenium used (4 mg/L) reduced the number of cells to $5.5 \times 10^8$ cfu/mL as compared to the yeast cells grown in the control medium (YPD) after 24 h of cultivation. In all experimental cultures supplemented with increasing doses of selenium (30 and 60 mg/L) after the completion of the logarithmic growth phase, the number of cells was lower than in the control cultures (YPD), and accounted for $3.0 \times 10^8$ and $1.8 \times 10^8$ cfu/mL. In all media supplemented with selenium and in the control medium after 48 h of cultivation, the number of yeast cells decreased and ranged from $5.4 \times 10^8$ to $3.8 \times 10^7$ cfu/mL. After 72 h of cultivation in the control medium and in medium supplemented with selenium, yeast cells showed signs of having reached the death phase.
The lowest number of cells (8.3 × 10⁶ cfu/mL) was observed after the third day of culturing in the medium containing selenium in an amount of 80 mg/L.

Nam et al. [26] reported that the growth of most strains of *Saccharomyces cerevisiae* was inhibited by a high concentration of selenium (above 125 mg/L) in the culture medium. The investigated *S. cerevisiae* ATCC 4126 and ATCC 26422 strains exhibited no growth in the medium supplemented with selenium at a dose of 50 mg/L, while the total inhibition of the growth of most yeast strains investigated occurred in the medium supplemented with selenium at a dose of 500 mg/L.

The results of the study presented by Ponce de Leon et al. [27] showed an inhibitory effect of selenium on the number of cells of *Saccharomyces cerevisiae* yeast (strain 15-6252). The yeasts were subjected to 24 h of cultivation in the YPD medium supplemented with sodium selenite (IV) at a dose between 10 and 50 mg/L. The highest number of yeast cells (2.6 × 10⁹ cfu/mL) was obtained in the control YPD medium. In terms of sodium selenite (IV) in an amount of 20 and 40 mg/L, the number of yeast cells decreased and accounted for 1.0 × 10⁹ cfu/mL and 5.3 × 10⁸ cfu/mL, respectively.

The results of the number of yeast cells obtained in experimental media suggest that the addition of selenium, as well as extension of the cultivation time until the third day, influenced the number of yeast cells. According to Mániková et al. [28] and Brozmanová et al. [24], yeasts exhibit the ability to metabolize compounds containing selenium. These processes may lead to a change in the degree of toxicity of this element in yeast cells, which in turn could affect the reduction in the number of yeast cells in the experimental media. The toxic effect of selenium could also be the result of its high chemical similarity to sulfur [29]. Selenium is involved in the metabolic pathway of this element (i.e., sulfur) in the yeast cell structures. It occurs in many proteins, changing their conformational structure and functional activity. The right dose of selenium also affects the occurrence of changes in the activity of antioxidant enzymes and glutathione [7].

### 3.2. Determination of Selenium Content in Yeast

During 24 h of experimental cultivation in media supplemented with the lowest doses of selenium (4 and 8 mg/L), the selenium content permanently bound to yeast cell biomass was estimated at 140 and 326 μg/g, respectively. In the next day of cultivation (after 48 h), the selenium level was higher and accounted for 169 and 770 μg/g, respectively (Figure 2). Extension of the cultivation until the third day did not result in any significant increase in the accumulation of this element in the yeast cell biomass of *C. utilis*.

Presumably, defense mechanisms leading to detoxification of the element in yeast cells were the main reason for different selenium content in the cellular biomass. The excess of selenium can be transported in yeast to the extracellular environment by means of membrane vesicles. They carry selenoprotein complexes across the cytoplasmic membrane [30–32]. Experiments carried out by Tarze et al. [33] showed that detoxification of selenium in the presence of thiol compounds is associated with the release of H:Se into the cell exterior of yeast. Experiments carried out by Stabnikova et al. [34] showed that baker’s yeast (*Saccharomyces cerevisiae*) grown for 72 h in media supplemented with sodium hydroxyselenite (IV) (2–12 mg/L) were able to bind selenium at a concentration range between 15 and 203 μg/g.

Results obtained by Nam et al. [26] showed that the addition of selenium to the YM (Yeast Mold) culture medium (24 h) at a concentration between 30 and 125 mg/L led to an increase in the content of selenium in the cell biomass of *Saccharomyces cerevisiae* 6 M in the range between 1039 and 5003 μg/g. The process of selenium uptake by *Pediococcus acidilactici* ATCC 8042 was described by Kousha et al. [35]. It was found that lactic acid bacteria cultured for 24 h in MRS medium with sodium selenite (IV) at a concentration in the range between 0.5 and 4 mg/L bound large amounts of selenium (0.17–1.89 mg/g). Mörschbächer et al. [36] reported that the concentration of accumulated selenium in the biomass of two strains of *Lactobacillus paracasei* (ML13 and CH135) were approximately 38 and 40 mg/g in a culture exposed to 150 mg Se⁴+/L in the MRS medium.
Figure 2. Changes in the content of selenium (\(\mu g/g_{dw}\)) in the cell biomass of \(C.\) utilis yeast after cultivation in the control (YPD) and in the experimental media enriched with selenium in the form of Na\(_2\)SeO\(_3\). *a*−*l* Means with the same letter did not differ significantly (\(p < 0.05\)).

The results obtained indicate the ability of \(C.\) utilis ATCC 9950 yeast cells to accumulate selenium not only in the logarithmic growth phase, but also during the stationary phase, as evidenced by the increase in the content of this element in the biomass of the yeast cells. According to the literature [29], dead microbial cells may bind metal ions through different physico-chemical mechanisms. The described results are in accordance with the conclusions made by Volesky and May-Phillips [37]. The authors of the cited report showed that dead cells of \(S.\) cerevisiae 1452-L6F (baker’s yeast) bound more uranium and zinc, approximately 40%, when compared to living cells.

In terms of medium supplemented with selenium at a dose of 20 mg/L, one obtained 903 \(\mu g/g\) after the first day of culturing and 1742 \(\mu g/g\) in the second day. Further extension of the experimental cultivation of \(C.\) utilis till 72 h resulted in the reduction of selenium content (1650 \(\mu g/g\)) in yeast cell biomass. It was probably related to the formation of volatile methyl derivatives of selenium compounds during the conversion of selenium from yeast biomass [38]. At selenium concentrations above 30 mg/L in experimental media, one observed an increase in the content of this element in yeast biomass after 72 h of cultivation.

Evaluation of selenium binding to yeast cells after 72 h of cultivation at a concentration of this element expressed by a dose of 80 mg/L in the experimental medium showed a rapid increase in the content of this element (4658 \(\mu g/g\)) in the yeast cell biomass. At the same time, it was observed that yeast cell biomass was red-brown in color (Figure 3). This also occurred to a lesser extent for lower doses of selenium (30, 40 mg/L) after 72 h of cultivation. The color of yeast biomass in this case was orange.

Research presented by Wang et al. [39] showed that \(Rhodotorula\) glutinis X-20 yeast grown in 30 mg Se\(^{4+}/L\) supplemented medium is able to accumulate selenium at a level of 5349.6 \(\mu g/g\) after 36 h of cultivation. An interesting course of changes in the bioaccumulation of selenium in the cell biomass of \(Enterococcus\) durans \(LAB18s\) was presented by Pieniz et al. [40]. The authors showed that bacteria are able to bind selenium in the range from 8449 to 61524 \(\mu g/g\) when the concentration of sodium selenite added to the culture medium was 15 to 120 mg/L, respectively. In a recent study, Kieliszek et al. [41] showed that the accumulation of selenium by \(Candida\) utilis ATCC 9950 and \(Saccharomyces\) cerevisiae ATCC MYA-2200 growing in medium with 60 mg Se\(^{4+}/L\) after a 72-h culture reached a selenium value of 5470 and 5640 \(\mu g/g\), respectively. It should be noted that in this study, selenium was determined by spectrophotometry using the Variamine Blue reagent.
Figure 3. Selected images of wet cell biomass of *C. utilis* yeast from 72-h cultivation in the control (YPD) (A) and in the experimental media enriched with selenium ((B) 4 mg/L; (C) 20 mg/L; (D) 30 mg/L; (E) 80 mg/L; (F) 100 mg/L).

This phenomenon indicates the accumulation of the elemental form of selenium in yeast cell structures. Gharieb and Gadd [42] and Kieliszek et al. [31] found large quantities of selenium occurring in the reduced form in the vesicular structures of yeast cell biomass, thereby reducing its value as a source of selenium in a highly absorbed form. For selenium concentrations below 30 mg/L, no significant phenomenon related to the occurrence of amorphous elemental selenium was observed after 72 h of culturing (Figure 3).

Selenium concentrations above 30 mg/L in the experimental media resulted in the yeast cell biomass turning red in color just after the first day of culturing. The observed color change indicates that to a large extent the resulting yeast biomass contains selenium in an inorganic form, which was also characterized by low bioavailability. It can be concluded that the occurrence of discoloration of the culture and the yeast biomass shows that, to a large extent, the cells contained selenium in an inorganic form in their cellular structures, which is biologically useless [33,43]. In this situation, experimental media supplemented with selenium at doses of 20 and 30 mg/L may be used for the production of fodder yeast biomass enriched with this element, which occurs mostly in an organic form.

The results of this work show that yeast enriched with selenium can be an interesting alternative to the production of supplements in dietary or pharmaceutical preparations to supplement deficiencies of this element in the diet. In addition, the results obtained can find promising use in the production of animal feed preparations.

3.3. Determination of Protein Content in Yeast

The protein content in yeast cells may be related to the selenoproteins present in the yeast cell structures. Selenium in combination with proteins is easily absorbed and may constitute an effective component of our daily diet.

During the initial stage of cultivation, directly after the introduction of inoculum to the experimental and control media, the total protein content in all the tested yeast cell samples of biomass ranged from 43.5% to 44.6% (Figure 4). In terms of yeast biomass from selenium-enriched experimental media (20, 30 and 60 mg/L), after 24 h of cultivation, the protein content ranged from 35.4% to 40.7%.
On another day of yeast cultivation (after 48 h), when compared to *C. utilis* cells in control YPD medium, the protein content in the yeast cultures obtained from experimental cultures with increasing concentrations of selenium (20, 30 and 60 mg/L) decreased by 3%, 4% and 19%, respectively. The presence of 60 mg Se⁴+/L in the experimental medium significantly influenced the reduction of protein content as compared to the control culture. Extension of the cultivation by 72 h in the control media without the addition of selenium also significantly decreased the protein content in the biomass of yeast cell by approximately 5.7%.

In experimental media supplemented with selenium at doses of 20, 30 or 60 mg/L after 72 h of cultivation, the protein content in the yeast cell biomass ranged from 33.6% to 37.7%. The results obtained after the third day of cultivation were significantly different when compared to the protein content of the initial growth phase (directly after the introduction of inoculum). However, it was reported that the differences in the protein content of *C. utilis* yeast biomass from experimental media supplemented with selenium (20, 30 and 60 mg/L) were not significant.

![Figure 4](image)

**Figure 4.** Changes in total protein content (%) in *C. utilis* yeast cells after cultivation in the control (YPD) and in the experimental media enriched with selenium in the form of Na₂SeO₃. Means with the same letter did not differ significantly (*p* < 0.05).

The reduction of the protein content in yeast cell biomass during the extension of the cultivation time could be the result of autolysis processes (effluence of lysosomal, hydrolytic enzymes). Based on the obtained results, it can be assumed that the lower protein content in yeast biomass from experimental media, when compared to the control culture, could be the result of the formation of the elemental form of selenium. This is one example of yeast detoxification processes. Metabolic changes in yeast cells due to the presence of selenium may lead to conformational changes in the polymers of the yeast cell wall. The consequence of these processes is a change in the permeability of lipid membranes [28].

According to Schrauzer [17], fodder yeast may contain approximately 46%–65% of protein. In the case of dried brewer’s yeast (*Saccharomyces cerevisiae*), protein content in the biomass ranged from 40% to 50% [44]. It should be emphasized that the protein content in the yeast cell biomass is dependent on many factors: medium composition, culture conditions and individual characteristics of the strain.

Test results obtained by Musial et al. [45] showed that the protein content of *Yarrowia lipolytica* A-101 yeast species cultured in crude rapeseed oil enriched with selenium (NaHSeO₃), at a dose between 1 and 6 mg/L, ranging from 56.4% to 24.7%. In the case of using glucose syrup as a selenium-enriched culture medium (4 mg/L), the protein content in *Y. lipolytica* A-101 yeast was estimated at approximately 45%. According to Dobrzanski et al. [46], fodder yeasts enriched with selenium with
the trade name Biocer® (Y-Se) contain approximately 36% of total protein. The obtained results of the protein content in C. utilis yeast cells are comparable with literature data [45,46].

The results of this study showed that selenium-enriched biomass yeast can be used for the production of various dietary supplements containing protein. Selenium bioplexes give the opportunity to obtain new products that will find particular interest among consumers. It is worth noting that the addition of selenium at a dose of 20 and 30 mg/L did not drastically decrease the total protein content as compared to the control culture, and therefore does not exclude the possibility of the formation of selenoprotein biocomplexes in the cell biomass of the tested C. utilis ATCC 9950 strain.

4. Conclusions

The enrichment of yeast biomass with selenium is a natural method in which the biological properties of cells in terms of bioaccumulation of this element are used. It was found that increased doses of selenium in experimental media lead to the reduction of the cell number, protein and yeast biomass content as compared to the control cultures (YPD). Short yeast cultivation times (up to 48 h) and the concentration of selenium between 20 and 30 mg/L seem to be the most effective from the viewpoint of industrial production. After 48 h of culturing, a significant increase in the content of this element in the yeast biomass (1742–3240 μg/g dry weight) was reported.

The addition of selenium in the amount of 20–30 mg/L after 24 and 48 h of cultivation did not result in the occurrence of the red color of yeast biomass, which could indicate that the selenium in the yeast biomass is in an organic form. The addition of selenium in the amount of more than 30 mg/L resulted in the cell biomass turning red-brown in color, which indicates that the accumulation of selenium is in the elemental form, which is useless and poorly absorbed in yeast cell structures. The content of selenium present in food and fodder is varied. The most valuable and safe method of supplementation would be a yeast preparation enriched with organic forms of selenium [47].

With the use of modern technology, solutions can be found to increase the health value of foods. Through enrichment of cell biomass with selenium, one can produce novel food products, which offer the possibility of their further use in the production of various dietary supplements. Yeast preparations containing selenium could be the answer to supplementing our daily diet with this element.

Author Contributions: M.K. collected and reviewed the literature and writing of manuscript; drafted and critically. M.K., A.M.K., K.P. performed the experiments, M.K., K.P. compilation of results, M.K. and S.B. reviewed the manuscript, supervision. All authors have read and agreed to the published version of the manuscript. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by internal grant no. 505-10-092800-A-01135-99 from the Faculty of Food Technology, Warsaw University of Life Sciences and this publication has been co-financed with the European Union funds by the European Social Fund (EFS).

Conflicts of Interest: The authors declare no conflicts of interest.

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