# Temperature and Concentration Dependencies of the Electrical Conductance of Potassium Tellurite Solutions in Ordinary and Heavy Water

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On the basis of conductometric measurements, empirical equations were derived, describing the temperature and concentration dependencies of the electrical conductance of $K_2TeO_3$ solutions in ordinary and heavy water. The values of the equivalent conductivity of the ions at infinite dilution in both solvents were determined in the temperature region (12 to 45) °C, using the expressions for 1:2 valent electrolytes of the semiempirical Fuoss−Onsager equation. These values were compared with respect to the nature of the solvent.

## Introduction

Tellurites, in particular $K_2TeO_3$, are not studied enough. There are some papers concerning the basic thermodynamic functions of the state of $K_2TeO_3$,[1,2] its structure,[3−5] IR spectrum,[6] and thermal stability.[7,8] The solid $K_2TeO_3$ is used as a component in the production of tellurite glasses,[9−13] and the aqueous solutions of $K_2TeO_3$ are suitable for producing marginally soluble tellurites from which the corresponding tellurides are prepared by reduction with $H_2$ or CO under heating. Some of these tellurides have interesting semiconducting properties.[14−17] $K_2TeO_3$ itself has a ferroelectric behavior.[18] Recently, $K_2TeO_3$ and its solutions have been used in medicine because they have an anti-sickling effect,[19,20] and in microbiology the oxyanion tellurite, $TeO_3^{2-}$, can be used as a tool to detect and quantify the release in soil microcosms of *Pseudomonas pseudoalcaligenes* KF707[21] and as a reagent for rapid drug susceptibility testing of *Escherichia coli*.[22−28]

The use of the solvents $H_2O$ and $D_2O$, which have different densities, viscosities, and dielectric constants, allows the solvent isotope effect to be studied using the electrical conductance.[29−32] According to published results,[33−36] the electrical conductance of ions is always greater in light water than in heavy water. For example, at 25 °C the differences between the limiting equivalent conductance at infinite dilution of $OH^-$ and $OD^-$ as well as $H^+$ and $D^+$ are 41.4 and 33.3 %, respectively.[35,36] For other ions this difference is between (15 and 19) %.[33,34] With increasing temperature these differences decrease. It is the first evidence for the distinctive differences in the behavior of an isotopically substituted substance. In going from light to heavy water, one of the bulk properties upon which the conductance depends, the viscosity, changes by 23 %, while another bulk property, the dielectric constant, changes by only 0.4 %.[33] The practical implementation of some heavy water solutions is connected with their use in the control of nuclear activity in CANDU nuclear reactors[37,38] as well as for studies of the so-called "cold fusion" phenomenon.[39,40]

All the facts, mentioned above, have led to an extensive research of the electrical conductivity of diluted aqueous solutions of $K_2TeO_3$ in a broad temperature range using isotopically substituted solvents. The present paper reports the temperature and concentration dependencies of the electrical conductivity of potassium tellurite solutions in ordinary and heavy water. The coefficients in the corresponding empirical equations are derived, and the influence of the isotopic substitution in the solvent on the electrical conductance of $K_2TeO_3$ solutions is compared.

## Experimental Section

The initial solutions were prepared by diluting a precisely weighed amount of $K_2TeO_3$ (Aldrich) in double-distilled ordinary water with specific conductivity $\kappa = 9.2 \pm 10^{-7}$ $S\cdot cm^{-1}$ at 25 °C and in 99.85 % $D_2O$ (Fluka) with specific conductivity $\kappa = 3.8 \pm 10^{-7}$ $S\cdot cm^{-1}$ at 25 °C, which were placed in a 250 $cm^3$ volumetric flask at 20 °C. The concentration of Te(IV) in the initial solutions was determined by oxidation with a solution of $K_2Cr_2O_7$, an excess of which was titrated against a standardized solution of ammonium iron(II) sulfate solution (Mohr's salt).[41] A series of eight solutions with concentrations from (0.1000 to 0.0028) $equiv\cdot dm^{-3}$ was prepared by diluting an aliquot of the initial solutions with the appropriate solvent in a 100 $cm^3$ volumetric flask, placed in a thermostat at 20 °C. The specific conductivities of these solutions were measured using a digital conductivity meter, Inolab Level-1 WTW (Germany), having a conductometric cell constant $0.4752 \pm 0.0002$ $cm^{-1}$. According to the technical specification of the apparatus, the relative error of the electrical conductivity measurements should be ± 0.02 %. The measurements were carried out at 1° increments in the temperature range (5 to 45) °C for light water solutions and in the temperature interval (12 to 45) °C for heavy water solutions. The temperature was maintained with a precision of ± 0.05 °C using an Ultrathermostat U-1; 50 $cm^3$ of each sample was pipetted in a 70 $cm^3$ glass container equipped with a water jacket. The measurements were performed under constant pressure and continuous stirring (600 rpm) by an electromagnetic stirrer. To avoid changes in the electrical conductivity of the sample due to dissolution of $CO_2$ or other gases, present in air, the container was sealed with a rubber cap through which the conductivity cell had been inserted. The relative error of the measurements (temperature, concentration and specific conductivity) was < 0.1 % during the experiments. The experimental data were processed by the mean square method.

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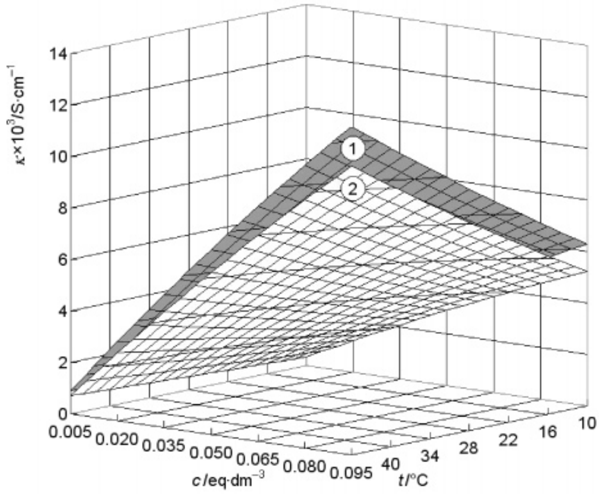

**Figure 1.** Temperature and concentration dependence of the specific conductivity of $K_2TeO_3$ in $H_2O$ (1) and $D_2O$ (2).

## Results and Discussion

Figure 1 shows the concentration and temperature dependence of the specific conductivity of $K_2TeO_3$ in ordinary and heavy water, respectively. As can be seen from the figure, the specific conductivity of $K_2TeO_3$ solutions in $H_2O$ was higher than that in $D_2O$ at any concentration and temperature. This is due to the higher density and viscosity of $D_2O$ as compared to $H_2O$. Using the mathematical approach described in detail earlier,[42] the coefficients in the empirical equations, describing the dependence $\kappa = f(t, c)$ of the studied solutions, were found to be:

$$\kappa_{H_2O} = 3.6489 \times 10^{-5} + 1.3175 \times 10^{-6}t + 2.5872 \times 10^{-8}t^2 + (5.4472 \times 10^{-2} + 1.7834 \times 10^{-3}t + 6.0974 \times 10^{-6}t^2)c - (5.4571 \times 10^{-2} + 2.0140 \times 10^{-3}t + 1.4208 \times 10^{-5}t^2)c^2 \quad (1)$$

$$\kappa_{D_2O} = 1.1869 \times 10^{-5} + 5.7919 \times 10^{-7}t + 5.3992 \times 10^{-9}t^2 + (4.4066 \times 10^{-2} + 1.6984 \times 10^{-3}t + 4.9961 \times 10^{-6}t^2)c - (4.7497 \times 10^{-2} + 2.2695 \times 10^{-3}t + 4.9045 \times 10^{-6}t^2)c^2 \quad (2)$$

were $t$ is the temperature in °C and $c$ is the analytical concentration of the solutions in equiv·dm$^{-3}$. These empirical equations describe the surfaces presented in Figure 1 and can be used to calculate the analytical concentration of potassium tellurite in light or heavy water. The specific conductance of the solutions, calculated according to eqs 1 or 2, was determined with a relative error about 0.8 % only for the highest concentrations and temperatures of the solutions. In all other cases the relative error was lower than 0.2 %. The standard deviations were between 0.0071 and 0.0249. The Student's criterion was calculated at $\alpha = 0.95$ and had values between 2.128 and 2.306.

The values of the equivalent conductivity $\Lambda$ of $K_2TeO_3$ solutions in $H_2O$ and $D_2O$ were calculated, using the values of the specific conductivity $\kappa$ of the solutions at corresponding temperatures and concentrations and the relationship between the specific and the equivalent conductivities ($\Lambda$) of the solutions:[43]

$$\Lambda = \frac{\kappa}{c} = \sum_{i=1}^{n} \frac{|z_i| c_i \lambda_i}{c} \quad (3)$$

where $\lambda_i$ are the ionic conductances, $c_i$ and $z_i$ are concentrations and charges of individual ions present in the solution and $c$ denotes the analytical electrolyte concentration. Some of the results are presented in Table 1.

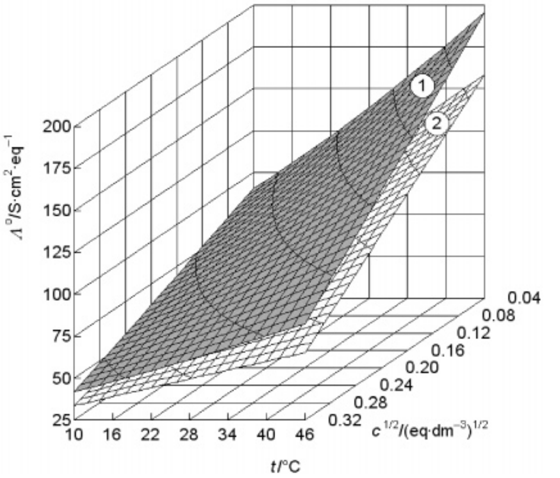

**Figure 2.** Temperature and concentration dependence of $\Lambda$ for $K_2TeO_3$ in $H_2O$ (1) and in $D_2O$ (2).

**Table 1. Values of the Equivalent Conductance $\Lambda$/S·cm$^2$·equiv$^{-1}$ of $K_2TeO_3$ in $H_2O$ and $D_2O$ at Different Concentrations and Temperatures**

| c | t/°C | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| equiv·dm$^{-3}$ | 12 | 15 | 20 | 25 | 30 | 35 | 40 | 45 |
| | | | | $K_2TeO_3-H_2O$ | | | | |
| 0.09837 | 69.33 | 74.62 | 83.56 | 92.61 | 102.06 | 111.92 | 121.89 | 132.05 |
| 0.04919 | 73.39 | 79.08 | 88.64 | 98.39 | 108.76 | 119.33 | 130.11 | 141.29 |
| 0.03935 | 74.97 | 80.56 | 90.47 | 100.38 | 111.05 | 121.73 | 132.91 | 144.35 |
| 0.02951 | 76.58 | 82.34 | 92.51 | 103.02 | 113.86 | 125.04 | 136.56 | 148.42 |
| 0.01967 | 78.80 | 84.95 | 95.53 | 106.51 | 118.20 | 129.89 | 141.84 | 154.30 |
| 0.00984 | 82.37 | 88.92 | 100.15 | 111.84 | 124.03 | 136.84 | 150.20 | 163.77 |
| 0.00590 | 84.75 | 91.53 | 103.22 | 115.25 | 127.97 | 141.27 | 155.25 | 169.32 |
| 0.00393 | 87.02 | 93.89 | 105.85 | 118.45 | 131.55 | 145.29 | 159.41 | 174.05 |
| | | | | $K_2TeO_3-D_2O$ | | | | |
| 0.09007 | 58.68 | 63.45 | 71.78 | 80.27 | 89.15 | 98.09 | 107.42 | 116.80 |
| 0.04504 | 61.94 | 67.16 | 76.04 | 85.04 | 94.36 | 104.02 | 113.90 | 123.78 |
| 0.03603 | 63.14 | 68.42 | 77.44 | 86.73 | 96.17 | 105.88 | 116.01 | 126.14 |
| 0.02702 | 64.03 | 69.39 | 78.65 | 88.27 | 98.08 | 108.07 | 118.06 | 128.61 |
| 0.01802 | 65.26 | 70.81 | 80.30 | 90.12 | 100.22 | 110.49 | 120.98 | 132.08 |
| 0.00901 | 67.20 | 72.81 | 82.57 | 92.51 | 102.89 | 113.54 | 124.58 | 135.74 |
| 0.00540 | 68.15 | 73.80 | 83.70 | 93.80 | 104.26 | 114.81 | 126.02 | 137.13 |
| 0.00360 | 68.61 | 74.17 | 84.17 | 94.44 | 104.86 | 115.56 | 126.67 | 138.06 |

Figure 2 shows the dependence $\Lambda = f(t, c^{1/2})$ for the solutions of $K_2TeO_3$ in $H_2O$ and $D_2O$, respectively, which is based on the results for the equivalent conductance at different concentrations and temperatures. The values of the limiting equivalent conductance $\Lambda^o$ of $K_2TeO_3$ solutions in $H_2O$ and $D_2O$ at the corresponding temperatures can be obtained according to the Kohlrausch equation:[44]

$$\Lambda = \Lambda^o - A\sqrt{c} \quad (4)$$

which describes a linear dependence of the equivalent conductivity of strong electrolytes on the square root of solution concentration. The extrapolation to a zero concentration gives the limiting equivalent conductivity $\Lambda°$, and the slope of the straight line—the $A$ coefficient.

The coefficient $A$ in eq 4 can be theoretically calculated using the limiting Onsager law:[44]

$$\Lambda = \Lambda^o - (B_1\Lambda^o + B_2)\sqrt{c} = \Lambda^o - S\sqrt{c} \quad (5)$$

where the coefficients $B_1$ and $B_2$ take into account relaxation effects of the ions motion in the solution and electrophoretic effects, respectively. These coefficients depend on the absolute temperature $T$, viscosity $\eta$, and dielectric constant $\epsilon$ of the solvent.

The values of $\Lambda^{o}$ obtained from eq 4 at different temperatures were used in the semiempirical Fuoss−Onsager equation[42,45−48] to calculate more precisely the values of $\Lambda^{o}$:

$$\Lambda = \Lambda^{o} - S\sqrt{c} + Ec\ln c + J_1 c + J_2 c^{3/2} \tag{6}$$

Equation 6 is applicable for non-associated ionophores. Here, $S$ is the limiting slope of the Onsager equation and the $E$, $J_1$, and $J_2$ values are determined by relaxation and electrophoretic effects and depend on $\Lambda^{o}$, $\eta$, $\epsilon$, and $T$. Besides, the coefficients $J_1$ and $J_2$ depend on the distances of the closest approach $\mathring{a}$ between cation and anion centers. The coefficients of eq 6 for 1:2 valent electrolytes are described in detail by Barthel[49] and Vlaev et al.:[50]

$$\begin{aligned}
&\Lambda = \Lambda^{o} - \Bigg\{\frac{6.4671\times10^{6}\Lambda^{o}}{(\epsilon T)^{3/2}[1+\lambda_{+}^{o}/\Lambda^{o}+0.8165(1+\lambda_{+}^{o}/\Lambda^{o})^{1/2}]} + \\
&\frac{214.3533}{\eta(\epsilon T)^{1/2}}\Bigg\}c^{1/2} + \Bigg[\frac{3.5289\times10^{13}\Lambda^{o}}{(\epsilon T)^{3}} - \frac{7.7959\times10^{8}}{\eta(\epsilon T)^{2}}\Bigg]c\ln c + \\
&\quad\Bigg\{\Bigg\{\frac{7.0579\times10^{13}}{(\epsilon T)^{3}}\Bigg[-2.68\times10^{7}(\mathring{a}\epsilon T)^{3} + 1.7911\times \\
&10^{5}(\mathring{a}\epsilon T)^{2} + 5.985\times10^{2}\mathring{a}\epsilon T + 0.9074 + \ln\frac{8.7091\times10^{9}\mathring{a}}{(\epsilon T)^{1/2}}\Bigg]\Bigg\} \\
&\Lambda^{o} + \frac{214.3533}{\eta(\epsilon T)^{1/2}}\Bigg[\frac{6.4671\times10^{6}\Lambda^{o}}{(\epsilon T)^{3/2}[1+\lambda_{+}^{o}/\Lambda^{o}+0.8165(1+\lambda_{+}^{o}/\Lambda^{o})^{1/2}]} + \\
&\frac{7.9832\times10^{9}\mathring{a}}{(\epsilon T)^{1/2}} - \frac{3.6377\times10^{6}}{(\epsilon T)^{3/2}}\Bigg(1.017 + \ln\frac{8.7091\times10^{9}\mathring{a}}{(\epsilon T)^{1/2}}\Bigg)\Bigg]\Bigg]\Bigg\} \\
&\quad c + \Bigg\{\Bigg\{\frac{1.4524\times10^{21}}{(\epsilon T)^{9/2}}[2.68\times10^{7}(\mathring{a}\epsilon T)^{3} + 1.7912\times \\
&10^{5}(\mathring{a}\epsilon T)^{2} - 3.225\times10^{2}\mathring{a}\epsilon T]\Bigg\}\Lambda^{o} + \frac{1.6258\times10^{22}\mathring{a}^{2}}{\eta(\epsilon T)^{3/2}}\Bigg\}c^{3/2}
\end{aligned} \tag{7}$$

For the temperature dependence of the dielectric constant $\epsilon$ and the viscosity $\eta$ of ordinary water, the following empirical equations were used:[51−53]

$$\log \epsilon_{H_2O} = 1.94409 - 1.991\times10^{-3}t \tag{8}$$

$$\log\frac{\eta_t}{\eta_{20}} = \frac{1.1709(20-t) - 0.001827(t-20)^2}{t+89.93} \tag{9}$$

For heavy water, eqs 10 and 11 were used:[51,54]

$$\log \epsilon_{D_2O} = 1.94275 - 2.013\times10^{-3}t \tag{10}$$

$$\log\frac{\eta_t}{\eta_{20}} = \frac{1.3580(20-t) - 0.00067(t-20)^2}{t+96.71} \tag{11}$$

The equation used for the temperature dependence of the limiting equivalent conductivity of $K^+$ ions in ordinary water was[55]

$$\lambda_{K^+}^{o}(H_2O) = 40.5017 + 1.2194t + 4.1859\times10^{-3}t^2 \tag{12}$$

and in heavy water:[56]

$$\lambda_{K^+}^{o}(D_2O) = 32.3892 + 1.1895t + 2.0463\times10^{-3}t^2 \tag{13}$$

**Table 2. Values of the Limiting Equivalent Conductance $\Lambda^{o}$/S·cm$^2$·equiv$^{-1}$ and the Coefficients $S$, $E$, $J_1$, $J_2$ and $\mathring{a}$ in Equation 7 for $K_2TeO_3$ Solutions in $H_2O$ and in $D_2O$ at Different Temperatures**

| $t$ | parameter | | | | | | |
|---|---|---|---|---|---|---|---|
| °C | $\Lambda^{o}$ | $S$ | $E$ | $J_1$ | $J_2$ | $\mathring{a}$/Å | $\sigma(\Lambda)$ |
| | | | | $K_2TeO_3-H_2O$ | | | |
| 5 | 84.40 | 148.74 | 128.31 | 572.91 | −157.94 | 1.771 | 0.0476 |
| 10 | 97.28 | 173.36 | 149.81 | 666.60 | −186.15 | 1.760 | 0.0541 |
| 12 | 102.56 | 183.63 | 158.77 | 706.21 | −198.05 | 1.757 | 0.0576 |
| 15 | 110.81 | 199.66 | 173.14 | 768.03 | −217.20 | 1.751 | 0.0611 |
| 20 | 125.19 | 227.81 | 199.02 | 877.19 | −252.02 | 1.740 | 0.0687 |
| 25 | 140.21 | 257.64 | 227.15 | 991.72 | −290.37 | 1.725 | 0.0757 |
| 30 | 156.08 | 289.33 | 258.29 | 1117.52 | −333.13 | 1.714 | 0.0850 |
| 35 | 172.58 | 322.70 | 292.10 | 1251.71 | −380.06 | 1.703 | 0.0912 |
| 40 | 189.82 | 357.88 | 329.17 | 1395.62 | −431.93 | 1.692 | 0.0984 |
| 45 | 207.62 | 394.72 | 369.20 | 1550.21 | −488.54 | 1.683 | 0.1079 |
| | | | | $K_2TeO_3-D_2O$ | | | |
| 12 | 81.95 | 145.03 | 129.94 | 619.74 | −159.96 | 1.921 | 0.0631 |
| 15 | 88.93 | 158.72 | 142.04 | 678.96 | −176.02 | 1.919 | 0.0708 |
| 20 | 101.17 | 182.96 | 163.97 | 783.38 | −205.67 | 1.911 | 0.0814 |
| 25 | 113.82 | 208.63 | 187.35 | 895.04 | −237.91 | 1.904 | 0.0933 |
| 30 | 126.87 | 235.73 | 212.36 | 1015.50 | −272.99 | 1.900 | 0.1054 |
| 35 | 140.32 | 264.21 | 239.17 | 1143.98 | −311.32 | 1.896 | 0.1193 |
| 40 | 154.30 | 294.20 | 268.45 | 1281.59 | −353.90 | 1.891 | 0.1316 |
| 45 | 168.70 | 325.57 | 300.05 | 1427.66 | −400.67 | 1.885 | 0.1466 |

Substituting the values of $\epsilon$, $\eta$, $\Lambda_{1/2K_2TeO_3}^{o}$, and $\lambda_{K^+}^{o}$ for the corresponding temperature and solvent into eq 7, the coefficients $S$, $E$, $J_1$, and $J_2$ were calculated, which allowed the temperature and concentration dependencies of the equivalent conductivity of $K_2TeO_3$ in ordinary and heavy water, respectively, to be studied. The "goodness" of the fit of the determined equivalent conductance is expressed by the mean-square deviation $\sigma(\Lambda)$, calculated by the equation:

$$\sigma(\Lambda) = \sqrt{\frac{\sum_{i=1}^{n}(\Lambda_{i,\mathrm{exp}} - \Lambda_{i,\mathrm{calc}})^2}{n-1}} \tag{14}$$

where $n$ is the number of conductance-concentration pairs.

The obtained values of $\Lambda_{1/2K_2TeO_3}^{o}$ as well as the mean-square deviation $\sigma(\Lambda)$ are presented in Table 2. It can be seen from Table 2 that the values of $\Lambda^{o}$ increase with temperature, while those for $K_2TeO_3$ in $H_2O$ remain higher due to the lower density and viscosity of ordinary water as compared to heavy water. The values of the limiting equivalent conductivity $\Lambda^{o}$ of $K_2TeO_3$ in $H_2O$ and in $D_2O$ in the temperature range (12 to 45) °C can be calculated by the following empirical equations:

$$\Lambda_{1/2K_2TeO_3}^{o}(H_2O) = 72.1555 + 2.3632t + 1.4442\times10^{-2}t^2 \tag{15}$$

$$\Lambda_{1/2K_2TeO_3}^{o}(D_2O) = 55.0817 + 2.1262t + 8.8621\times10^{-3}t^2 \tag{16}$$

The values of the limiting equivalent conductivity $\lambda^{o}$ for $TeO_3^{2-}$ anions in $H_2O$ and in $D_2O$, respectively, can be calculated in the studied temperature range knowing the temperature dependence of the limiting equivalent conductivity of $K^+$ ions in both ordinary and heavy water, which are presented in Table 3.

Table 3 shows that the values of $\Lambda_{1/2K_2TeO_3}^{o}$, $\lambda_{K^+}^{o}$, and $\lambda_{1/2TeO_3^{2-}}^{o}$ in $H_2O$ are higher than the same values in $D_2O$. This can be attributed to the lower values of the density and viscosity of $H_2O$ as compared to $D_2O$. It can be also seen that, at a given temperature, the values of the Walden's product for both solvents are practically the same, slightly decreasing with an

**Table 3. Values of the Limiting Equivalent Conductance at Infinite Dilution of the Molecule and the Ions of $K_2TeO_3$: $\Lambda^o_{1/2K_2TeO_3}$, $\lambda^o_{K^+}$, $\lambda^o_{1/2TeO_3^{2-}}$, and Walden's Product ($\Lambda^\circ\eta$) for Its Ordinary and Heavy Water Solutions at Certain Temperatures**

| $t$ | $K_2TeO_3-H_2O$ | | | | $K_2TeO_3-D_2O$ | | | |
|---|---|---|---|---|---|---|---|---|
| °C | $\Lambda^o_{1/2K_2TeO_3}$ | $\Lambda^o\eta$ | $\lambda^o_{K^+}$ | $\lambda^o_{1/2TeO_3^{2-}}$ | $\Lambda^o_{1/2K_2TeO_3}$ | $\Lambda^o\eta$ | $\lambda^o_{K^+}$ | $\lambda^o_{1/2TeO_3^{2-}}$ |
| 12 | 102.56 | 1.27 | 55.74 | 46.82 | 81.95 | 1.29 | 46.96 | 34.99 |
| 15 | 110.81 | 1.26 | 59.73 | 51.07 | 88.93 | 1.28 | 50.69 | 38.24 |
| 20 | 125.19 | 1.25 | 66.56 | 58.62 | 101.17 | 1.26 | 57.00 | 44.17 |
| 25 | 140.21 | 1.25 | 73.60 | 66.61 | 113.82 | 1.25 | 63.41 | 50.41 |
| 30 | 156.08 | 1.24 | 80.85 | 75.23 | 126.87 | 1.23 | 69.92 | 56.96 |
| 35 | 172.58 | 1.24 | 88.31 | 84.27 | 140.32 | 1.22 | 76.53 | 63.79 |
| 40 | 189.82 | 1.24 | 95.98 | 93.85 | 154.30 | 1.21 | 83.24 | 71.06 |
| 45 | 207.62 | 1.24 | 103.85 | 103.77 | 168.70 | 1.20 | 90.06 | 78.64 |

increase of temperature. The changes of the isotopic ratios $\Lambda^o_{1/2K_2TeO_3}$ ($H_2O$)/$\Lambda^o_{1/2K_2TeO_3}$ ($D_2O$), $\lambda^o_{K^+}$ ($H_2O$)/$\lambda^o_{K^+}$ ($D_2O$), and $\lambda^o_{1/2TeO_3^{2-}}$($H_2O$)/$\lambda^o_{1/2TeO_3^{2-}}$ ($D_2O$) with an increase of temperature can be assessed using Figure 3.

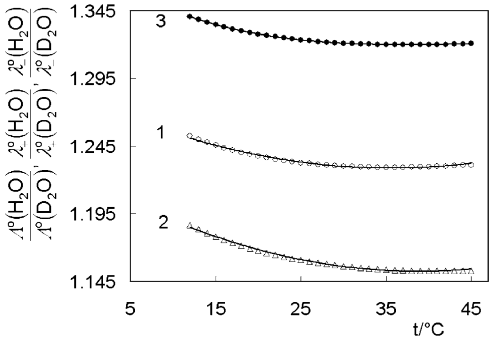

**Figure 3.** Temperature dependence of the isotopic ratios: $\Lambda^o_{1/2K_2TeO_3}$ ($H_2O$)/$\Lambda^o_{1/2K_2TeO_3}$ ($D_2O$) (1); $\lambda^o_{K^+}$ ($H_2O$)/$\lambda^o_{K^+}$ ($D_2O$) (2); and $\lambda^o_{1/2TeO_3^{2-}}$ ($H_2O$)/$\lambda^o_{1/2TeO_3^{2-}}$ ($D_2O$) (3).

Figure 3 shows that the values of the isotopic ratios slightly decrease with an increase of temperature. A similar tendency was observed for solutions of other salts in light and heavy water,[34,35] which could be explained by a decrease of the viscosities of ordinary and heavy water with an increase of temperature.

## Conclusion

For the first time the temperature and concentration dependence of the specific and equivalent conductivity of $K_2TeO_3$ is studied in light and heavy water solutions. The coefficients of the corresponding empirical equations are calculated. On this basis, the values of the limiting equivalent conductance of $TeO_3^{2-}$ ions are determined in both solvents in the temperature region (12 to 45) °C. The temperature dependence is determined for the isotopic ratios $\Lambda^o_{1/2K_2TeO_3}$ ($H_2O$)/$\Lambda^o_{1/2K_2TeO_3}$ ($D_2O$), $\lambda^o_{K^+}$ ($H_2O$)/$\lambda^o_{K^+}$ ($D_2O$), and $\lambda^o_{1/2TeO_3^{2-}}$ ($H_2O$)/$\lambda^o_{1/2TeO_3^{2-}}$ ($D_2O$). These isotopic ratios decrease with an increase of temperature. Since the comparisons of the electrical conductivity of ordinary and heavy water solutions are insufficient in the literature, the implemented study and the presented results add to the knowledge in this field of study. It may be concluded that the conductometric method can give useful information about the solution structure, the state of the ions, and the influence of the solvent isotopic effect on their properties. As the kinetic isotope effect can be observed not only when reagents consist of different isotopes but also when the used solvents are isotope substituted by $H_2O$ and $D_2O$, it is necessary that the values of the specific and the equivalent coductivity are compared with respect to the solvent—ordinary and heavy water. On this basis, the role of the solvent for the dissociation of the dissolving substance, the ion solvation, and the kinetics of ionic reactions in solutions can be estimated.

**Note Added after ASAP Publication.** The wrong concentrations were included in Table 1 in the version published ASAP January 6, 2007; the corrected version was published ASAP February 12, 2007.

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