

## Effect of sonication-assisted water extraction on the total antioxidant parameters of medicinal plants

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### INTRODUCTION & AIM

Medicinal plants are one of the sources of biologically active compounds that determine their therapeutic effect. Water infusions and decoctions, as well as tinctures and extracts, are currently used in phytotherapy and part of complex treatment of various human diseases.

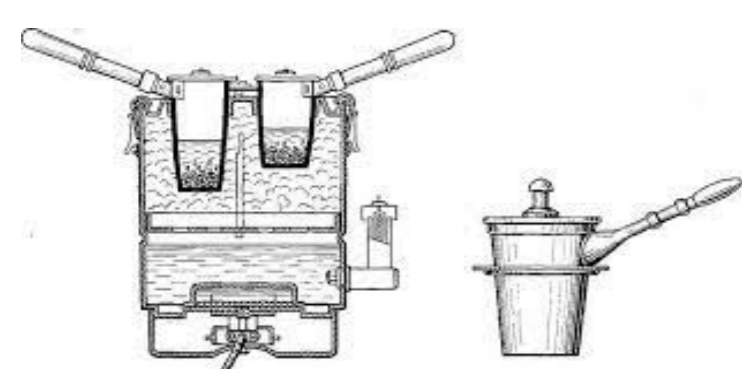
Sonication treatment is an effective approach to increasing the efficiency of active component extraction from plant material. Application of sonication reduces the time and consumption of extractant, as well as uses mild conditions. Sonication-assisted water extraction was applied to the various medicinal plants traditionally used in phytotherapy. Water extracts from herbs, leaves, bark, infructescences, flowers, roots, and rhizomes were studied using total antioxidant parameters obtained by constant-current coulometry.

### METHOD

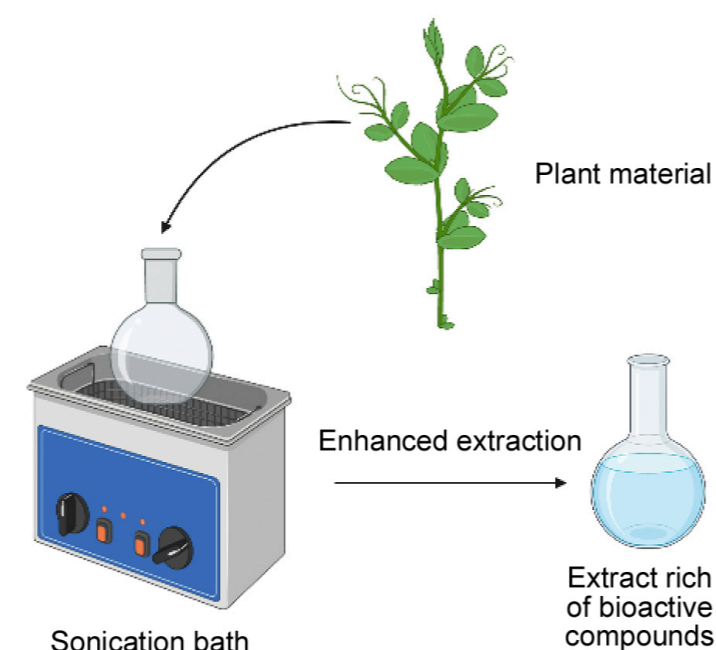
#### Plant material under study and extracts preparation

Extract type	Plant material	Plant : solvent ratio
Decoctions and sonication-assisted water extracts	<i>Quercus cortex</i>	1:10
	<i>Bergeniae rhizomata</i>	1:10
	<i>Potentillae rhizomata</i>	1:10
	<i>Chamomillae flores</i>	1:33
	<i>Sanguisorbae rhizomata et radices</i>	1:10
	<i>Frangulae cortex</i>	1:10
	<i>Uvae Ursi folia</i>	1:10
Infusions and sonication-assisted water extracts	<i>Alni fructus</i>	1:10
	<i>Leonuri herba</i>	1:10
	<i>Salviae folia</i>	1:10
	<i>Urticae folia</i>	1:33
	<i>Tiliae flores</i>	1:20

#### Traditional preparation of decoctions and infusions



#### Sonication-assisted extraction



#### Coulometric titration with electrogenerated bromine and ferricyanide ions

##### Total antioxidant capacity (TAC)

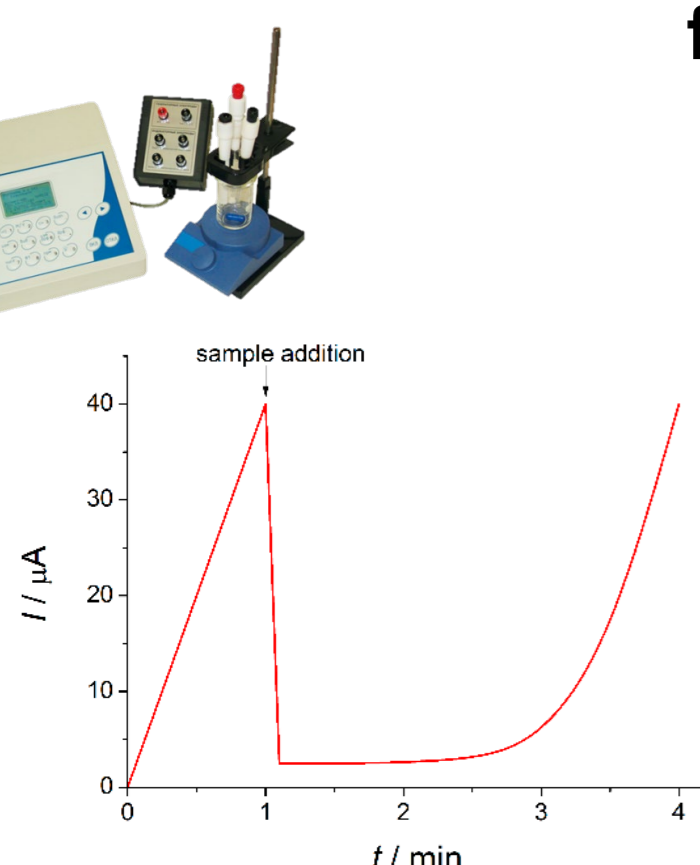
Anode:  $2\text{Br}^- - 2\text{e}^- = \text{Br}_2$

Solution: Oxidation reactions  
Electrophilic substitution in aromatic systems  
Electrophilic addition to multiple bonds

##### Ferric reducing power (FRP)

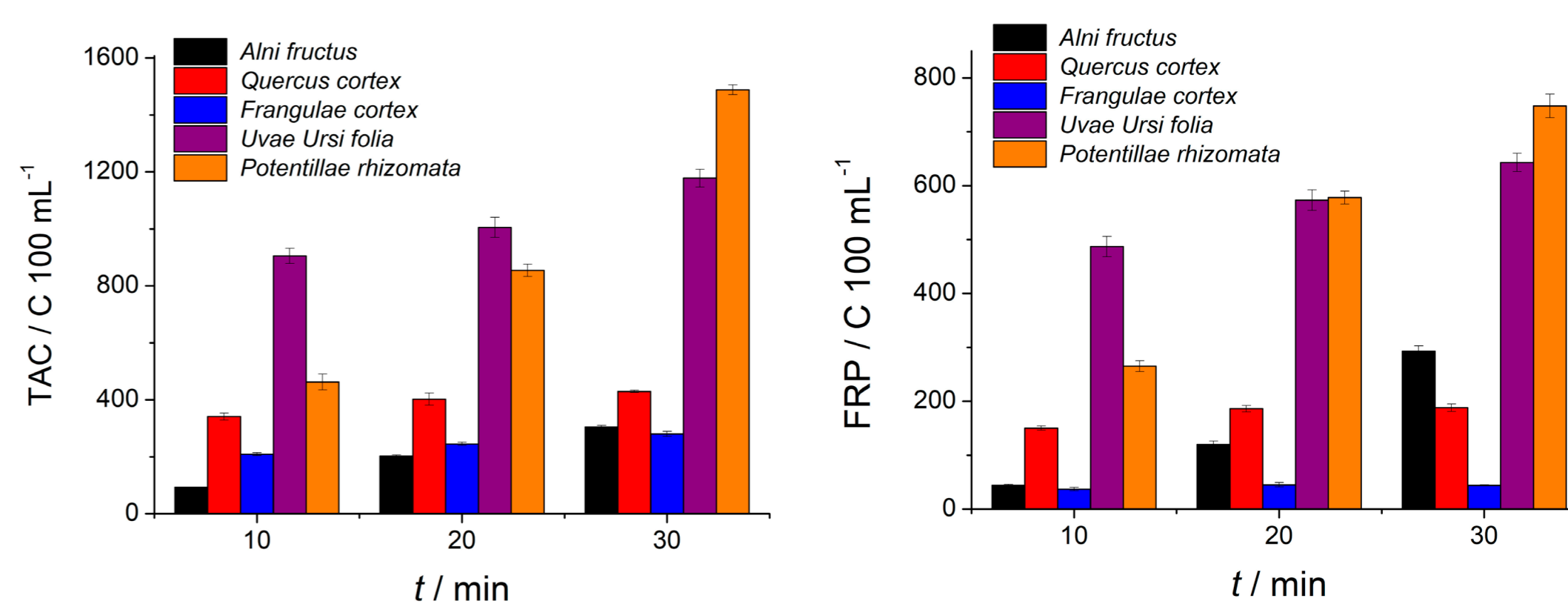
Anode:  $[\text{Fe}(\text{CN})_6]^{4-} - \text{e}^- = [\text{Fe}(\text{CN})_6]^{3-}$

Solution: Oxidation reactions



### RESULTS & DISCUSSION

#### Effect of sonication time on the antioxidant parameters of the extracts



Maximum TAC and FRP achieved for 30 min of sonication treatment.

#### Comparison of TAC and FRP of the extracts obtained by sonication and traditional method ( $n = 5$ ; $P = 0.95$ )

Plant material	Sonication for 30 min	RSD	Traditional method	RSD
TAC / C 100 mL <sup>-1</sup>				
<i>Alni fructus</i>	304±6	0.02	810±10	0.01
<i>Quercus cortex</i>	429±4	0.006	537±11	0.01
<i>Frangulae cortex</i>	280±9	0.03	444±7	0.01
<i>Uvae Ursi folia</i>	1178±31	0.02	1532±34	0.02
<i>Potentillae rhizomata</i>	854±22	0.02	1494±26	0.01
<i>Bergeniae rhizomata</i>	1390±60	0.04	1438±59	0.02
<i>Sanguisorbae rhizomata et radices</i>	1432±52	0.02	2271±120	0.04
<i>Leonuri herba</i>	105±5	0.03	132±3	0.01
<i>Tiliae flores</i>	123±4	0.03	245±11	0.05
<i>Salviae folia</i>	196±12	0.04	265±9	0.03
<i>Urticae folia</i>	52±2	0.04	64±2	0.01
<i>Chamomillae flores</i>	89±3	0.03	133±2	0.01
FRP / C 100 mL <sup>-1</sup>				
<i>Alni fructus</i>	293±10	0.03	558±15	0.02
<i>Quercus cortex</i>	188±7	0.03	214±5	0.024
<i>Frangulae cortex</i>	34±1	0.03	59±3	0.05
<i>Uvae Ursi folia</i>	643±17	0.02	922±44	0.03
<i>Potentillae rhizomata</i>	578±12	0.02	912±32	0.03
<i>Bergeniae rhizomata</i>	647±24	0.02	1044±25	0.01
<i>Sanguisorbae rhizomata et radices</i>	691±38	0.02	1001±30	0.02
<i>Leonuri herba</i>	54±1	0.02	67±2	0.03
<i>Tiliae flores</i>	64±1	0.01	133±6	0.03
<i>Salviae folia</i>	114±3	0.02	162±5	0.01
<i>Urticae folia</i>	16.8±0.8	0.04	20.6±0.8	0.03
<i>Chamomillae flores</i>	16.3±0.6	0.01	41±2	0.03

### CONCLUSION

The effect of sonication on the antioxidant parameters of water extracts from medicinal plants was evaluated on the basis of coulometric data. The TAC and FRP of samples are increased with the growth of sonication time. The best results are achieved within 30 min treatment. Further extension of the sonication time is inadvisable from practical point of view. The comparison of the antioxidant parameters for sonicated extracts with that ones for infusions and decoctions shows that traditional technology of decoctions and infusions preparation provides higher antioxidant parameters due to the conditions used for preparation (boiling for 30 and 15 min respectively). TAC and FRP for different methods are more consistent in the case of finely ground plant materials, such as leaves and herb while bark and rhizomes show more diverse data.