Estimation of toxicity via T.E.S.T. (v5.1) and WebTEST

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OBJECTIVES

- Redesign of the interface
- Improved structure searching
- Improved calculation speed
- Incorporation of Chemical Transformation Simulator (CTS)
- Mac OS version of T.E.S.T.
- Web interface for running T.E.S.T. models (WebTEST)
- WebTEST models can be accessed via API calls

APPROACH

- Downloadable T.E.S.T. Java application was redesigned to be more user friendly and run calculations faster
- T.E.S.T. was converted into a web-service based application (WebTEST)
- EPA’s CTS web-service was incorporated into the single chemical mode of T.E.S.T. to estimate properties of breakdown products

IMPACT

- T.E.S.T. has been made more accessible by redesigning the application and providing a web-based version.
- T.E.S.T. can now estimate the toxicity of environmental breakdown products via CTS

For more information:
martin.todd@epa.gov;
https://www.epa.gov/chemical-research/toxicity-estimation-software-tool-test;
https://comptox.epa.gov/dashboard/predictions/index
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T.E.S.T 5.1. Single Chemical Mode

- Search included database of 871K curated substances
- Options easily accessible
- Ability to run CTS

https://www.epa.gov/chemical-research/toxicity-estimation-software-tool-test
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T.E.S.T 5.1. Batch Mode

Batch searching

Batch results displayed in real time
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CTS Integration: estimate properties of breakdown products
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WebTEST Interface  
https://comptox.epa.gov/dashboard/predictions/index

Select properties to predict

T.E.S.T.
- Toxicological properties
  - 96 hour fathead minnow LC50
  - 48 hour D. magna LC50
  - 48 hour T. pyriformis IG50
  - Oral rat LD50
- Bioconcentration factor
- Developmental toxicity
- Ames mutagenicity
- Estrogen Receptor RBA
- Estrogen Receptor Binding

Physical properties
- Normal boiling point
- Melting point
- Flash point
- Vapor pressure
- Density
- Surface tension
- Thermal conductivity
- Viscosity
- Water solubility

Link to prediction reports
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**WebTEST “GET” API Call**

URL/endpointAbbr?smiles=desiredSmiles&method=methodAbbr

where URL = https://comptox.epa.gov/dashboard/web-test/

### Endpoint Abbreviations

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>Abbreviation</th>
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</thead>
<tbody>
<tr>
<td>Fathead minnow LC50 (96 hr)</td>
<td>LC50</td>
</tr>
<tr>
<td>Daphnia magna LC50 (48 hr)</td>
<td>LC50DM</td>
</tr>
<tr>
<td>T. pyriformis IGC50 (48 hr)</td>
<td>IGC50</td>
</tr>
<tr>
<td>Oral rat LD50</td>
<td>LD50</td>
</tr>
<tr>
<td>Bioaccumulation factor</td>
<td>BCF</td>
</tr>
<tr>
<td>Developmental Toxicity</td>
<td>DevTox</td>
</tr>
<tr>
<td>Mutagenicity</td>
<td>Mutagenicity</td>
</tr>
<tr>
<td>Normal boiling point</td>
<td>BP</td>
</tr>
</tbody>
</table>

### Method Abbreviations

<table>
<thead>
<tr>
<th>Method</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hierarchical clustering</td>
<td>hc</td>
</tr>
<tr>
<td>Single model</td>
<td>sm</td>
</tr>
<tr>
<td>Nearest neighbor</td>
<td>nn</td>
</tr>
<tr>
<td>Group contribution</td>
<td>gc</td>
</tr>
<tr>
<td>Consensus</td>
<td>consensus (default)</td>
</tr>
</tbody>
</table>

### WebTEST “GET” API Response

```json
{
  "predictions": [
    {
      "id": "C_1520539090089",
      "smiles": "OCC",
      "expValMolarLog": "-1.337",
      "expValMass": "1001180.703",
      "predValMolarLog": "-1.338",
      "predValMass": "1002625.241",
      "molarLogUnits": "-Log10(mol/L)",
      "massUnits": "mg/L"
    }
  ],
  "uuid": "55547f4f-f966-48e8-b831-a0d217998064",
  "predictionTime": 1528539090089,
  "software": "T.E.S.T (Toxicity Estimation Software Tool)",
  "softwareVersion": "5.0.1",
  "condition": "Water solubility at 25°C",
  "endpoint": "Hierarchical clustering"
}
```
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Summary

- T.E.S.T. can now search EPA’s DSSTOX database
- Calculations are performed faster
- Properties of environmental breakdown products can now be estimated using CTS
- Calculations can now be run on the web using WebTEST using a graphical interface and API calls

Future work

- Map all data sets to DSSTOX identifiers
- Add additional data and endpoints/properties
- Add models to predict properties of PFAS
- Replace legacy QSAR methods with python web-service based methods (e.g. SVM, RF, DNN)
- Make single chemical output display in the software rather than web browser
- Batch mode of WebTEST

References


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