Package 'tikatuwq'

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Type Package

Title Water Quality Analysis Tools for the Brazilian Context

Version 0.4.6

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Description Tools to import, clean, validate, and analyze freshwater quality data in Brazil. Implements water quality indices including the Water Quality Index (WQI/IQA), the Trophic State Index (TSI/IET) after Carlson (1977) <doi:10.4319/lo.1977.22.2.0361> and Lamparelli (2004) <https://www.teses.usp.br/teses/disponiveis/41/41134/tde-20032006-075813/publico/TeseLamparelli2004.pdf>, and the National Sanitation Foundation Water Quality Index (NSF WQI) <https://www.nsf.org/education/nsf-water-quality-index>. The package also checks compliance with Brazilian standard CONAMA Resolution 357/2005 <https://conama.mma.gov.br/?id=450&option=com_sisconama&task=arquivo.download> and generates reproducible reports for routine monitoring workflows.

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LazyDataCompression xz

Depends R (>= 4.1)

Imports dplyr, readr, tibble, rlang, stats, utils, ggplot2, tidyr, lubridate, stringr, glue, scales, broom, purrr

Suggests testthat (>= 3.0.0), spelling, rmarkdown, knitr, pkgdown

VignetteBuilder knitr

URL https://github.com/tikatuwq/tikatuwq, https://tikatuwq.github.io/tikatuwq/

BugReports https://github.com/tikatuwq/tikatuwq/issues

Config/testthat/edition 3

RoxygenNote 7.3.3

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Contents

`clean_units` *Padroniza/unifica unidades (esqueleto)*

Description

Ponto de extensao para normalizar unidades (mg/L, uS/cm, etc.). Por ora retorna o data.frame sem alteracoes.

Usage

```
clean_units(df, units_map = NULL)
```

Arguments

`df`	data.frame/tibble de entrada.
`units_map`	opcional; mapa de unidades.

Value

O mesmo `df` (placeholder).

`conama_check` *Conformity check (default Class = "2") - detailed*

Description

For each parameter present in `df`, adds columns:

- `*_ok` (TRUE/FALSE),
- `*_status` ("ok", "acima_do_maximo", "abaixo_do_minimo"),
- `*__lim_min` and `*__lim_max` (limits used),
- `*__delta` (difference to the relevant limit; >0 if above max, <0 if below min, 0 if ok).

Usage

```
conama_check(df, classe = "2")
```

Arguments

`df`	tibble/data.frame com colunas de parametros (ph, turbidez, od, dbo, etc.).
`classe`	string da classe ("especial", "1", "2", "3", "4" ou conforme tabela).

Details

Se existirem multiplas linhas de limite para o mesmo parametro, a funcao:

- considera `*_ok` como TRUE se QUALQUER linha for atendida; e
- escolhe, para `status/lim_min/lim_max/delta`, a primeira linha que atende; se nenhuma atende, escolhe a que produz a menor violacao (menor |delta|).

Value

`df` com colunas adicionais por parametro.

conama_limits *Limits for Brazilian CONAMA 357/2005*

Description

Returns the parameter limits defined by CONAMA Resolution 357/2005 for a given water-use class.

Usage

```
conama_limits(class)
```

Arguments

class	Integer or character. Target class (e.g., 1, 2, 3, 4 or "special"), according to CONAMA 357/2005.

Value

A tibble/data frame with one row per parameter and the regulatory thresholds. Typical columns:

- parameter: parameter name (character)
- class: CONAMA class label (character/integer)
- limit_min: minimum allowed value (numeric, may be NA)
- limit_max: maximum allowed value (numeric, may be NA)
- unit: measurement unit (character)
- criterion: textual rule if applicable (character)

Examples

```
# class 2 thresholds
head(conama_limits(2))
```

conama_report *Conformity report (table)*

Description

Conformity report (table)

Relatorio de conformidade (tabela), com formato opcional

Usage

```
conama_report(
  df,
  classe = "2",
  only_violations = TRUE,
  pretty = FALSE,
  decimal_mark = ",",
  big_mark = "."
)

conama_report(
  df,
  classe = "2",
  only_violations = TRUE,
  pretty = FALSE,
  decimal_mark = ",",
  big_mark = "."
)
```

Arguments

df	dados de entrada
classe	classe CONAMA
only_violations	se TRUE, retorna apenas linhas com status != "ok"
pretty	se TRUE, devolve colunas formatadas para exibicao
decimal_mark	separador decimal (default ",")
big_mark	separador de milhar (default ".")

Value

tibble com: parametro, valor, lim_min, lim_max, status, delta

tibble

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conama_summary *Conformity summary (long format)*

Description

Conformity summary (long format)

Usage

```
conama_summary(df, classe = "2")
```

Arguments

df	dados de entrada
classe	classe CONAMA

Value

tibble com: parametro, valor, lim_min, lim_max, status, ok, delta

---

conama_text *Text summary of conformity (bulleted, formatted)*

Description

Text summary of conformity (bulleted, formatted)

Usage

```
conama_text(
  df,
  classe = "2",
  only_violations = FALSE,
  decimal_mark = ",",
  big_mark = "."
)
```

Arguments

df	dados de entrada
classe	classe CONAMA
only_violations	se TRUE, lista apenas parametros com violacao
decimal_mark	separador decimal (default ",")
big_mark	separador de milhar (default ".")

Value

character vector (linhas)

generate_analysis *Analytical paragraphs generation (rule-based, no AI)*

Description

Analytical paragraphs generation (rule-based, no AI)

Usage

```
generate_analysis(
  df,
  classe_conama = "2",
  incluir_tendencia = TRUE,
  parametros_tendencia = c("turbidez", "od", "pH"),
  contexto = list(rio = NA, periodo = NA, cidade = NA)
)
```

Arguments

df	Data frame with columns including at least ponto, and preferably parameters used by CONAMA checks and IQA computation
classe_conama	Character scalar with CONAMA class (e.g. "2")
incluir_tendencia	Logical; whether to compute simple time trends
parametros_tendencia	Character vector of parameter names to test trends
contexto	List with optional metadata, accepting PT or EN keys: rio/river, periodo/period, cidade

Value

Character vector of 3-5 analytical paragraphs

iet_carlson *Trophic State Index (Carlson) - basic*

Description

Trophic State Index (Carlson) - basic

Usage

```
iet_carlson(secchi = NULL, clorofila = NULL, tp = NULL)
```

Arguments

secchi	Numeric vector with Secchi depth (m)
clorofila	Numeric vector with chlorophyll-a (µg/L)
tp	Numeric vector with total phosphorus (µg/L)

Value

Data frame with TSI components and overall IET

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iet_lamparelli *Trophic State Index - Lamparelli (skeleton v0.2.1)*

Description

Trophic State Index - Lamparelli (skeleton v0.2.1)

Usage

```
iet_lamparelli(
  tp = NULL,
  chla = NULL,
  sd = NULL,
  ambiente = c("rio", "reservatorio")
)
```

Arguments

tp	Numeric total phosphorus (mg/L)
chla	Numeric chlorophyll-a (µg/L)
sd	Numeric Secchi disk depth (m)
ambiente	Environment type: 'rio' or 'reservatorio'

Value

Data frame with IET components and overall Lamparelli index

iqa *Water Quality Index (WQI / IQA)*

Description

Computes IQA/WQI for each site/date (or grouping).

Usage

```
iqa(
  df,
  pesos = c(od = 0.17, coliformes = 0.15, pH = 0.12, dbo = 0.1, nt_total = 0.1, p_total =
    0.1, turbidez = 0.08, tds = 0.08, temperatura = 0.1),
  altitude_m = 0,
  na_rm = FALSE
)

iqa(
  df,
  pesos = c(od = 0.17, coliformes = 0.15, pH = 0.12, dbo = 0.1, nt_total = 0.1, p_total =
    0.1, turbidez = 0.08, tds = 0.08, temperatura = 0.1),
  altitude_m = 0,
  na_rm = FALSE
)
```

Arguments

df	cols: pH, turbidez, od, dbo, nt_total, p_total, tds, temperatura, coliformes
pesos	pesos oficiais (ANA/CETESB)
altitude_m	altitude (m) p/ %sat de OD
na_rm	reescala pesos nos parâmetros presentes

Value

A tibble/data frame with columns such as site, date, iqa (numeric score), and class (qualitative label).

nsfwqi *NSF Water Quality Index (prototype v0.2.1)*

Description

NSF Water Quality Index (prototype v0.2.1)

Usage

```
nsfwqi(
  df,
 pesos = c(do = 0.17, fc = 0.16, ph = 0.11, bod = 0.11, temp_change = 0.1, po4 = 0.1,
    no3 = 0.1, turbidez = 0.08, sst = 0.07),
  na_rm = FALSE
)
```

Arguments

df	Data frame containing columns compatible with NSFWQI mapping
pesos	Named numeric vector with parameter weights
na_rm	Logical; allow NA and rescale weights

Value

Data frame with an added 'NSFWQI' column

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plot_box *Boxplots by site/parameter*

Description

Boxplots by site/parameter

Usage

```
plot_box(df, parametro, by = "ponto")
```

Arguments

df	Data frame with water quality data.
parametro	Character; parameter column name.
by	Character; grouping column (e.g., "site").

Value

A ggplot object (class ggplot) representing the boxplot.

plot_heatmap *Heatmap of parameters vs. sites*

Description

Heatmap of parameters vs. sites

Usage

```
plot_heatmap(df_long)
```

Arguments

df_long	Long-format data frame (site/parameter/value).

Value

A ggplot object (class ggplot) representing the heatmap.

plot_iqa *Plot IQA by site/date*

Description

Plot IQA by site/date

Usage

```
plot_iqa(df)
```

Arguments

df	Data frame returned by iqa() (or with equivalent columns).

Value

A ggplot object (class ggplot) representing IQA across sites/dates.

plot_series *Time series by parameter*

Description

Time series by parameter

Usage

```
plot_series(df, parametro, facet = NULL)
```

Arguments

df	Data frame with a data column (Date/POSIXct) and the chosen parameter column.
parametro	Character; parameter to plot (name of the numeric column).
facet	Character or NULL; optional grouping column name to facet/color.

Value

A ggplot object (class ggplot) showing the time series.

read_wq *Leitura padrao de dados de qualidade da agua*

Description

Aceita CSV com **virgula ou ponto** como separador decimal e ignora texto de unidades (ex.: "0,04 mg/L"). Lê tudo como texto, normaliza nomes e converte colunas numericas de forma robusta. Aplica um ajuste de seguranca em pH evidentemente fora da faixa (ex.: 72 -> 7.2).

Usage

```
read_wq(path, tz = "America/Bahia")
```

Arguments

path	Caminho do arquivo CSV.
tz	Fuso para datas (mantido por compatibilidade; datas sao Date).

Value

Um tibble com colunas normalizadas.

render_report *Render a report (R Markdown / Quarto) from the internal template*

Description

By default, writes to a temporary directory to comply with CRAN policies. The function returns the full path to the generated file.

Usage

```
render_report(
  df,
  meta = list(river = NA, period = NA),
  output_file = "wq_report.html",
  output_dir = tempdir(),
  template = system.file("templates", "report_rmd.Rmd", package = "tikatuwq")
)
```

Arguments

df	Data frame with input data used by the template
meta	Named list with contextual metadata (e.g., river, period)
output_file	Output file name (default 'wq_report.html')
output_dir	Directory where the file will be written (default tempdir())
template	Path to the internal template file

Value

Invisible character path to the generated report

resume_wq *Descriptive summaries by group*

Description

Descriptive summaries by group

Usage

```
resume_wq(df, by = c("ponto", "mes"), funs = c("mean", "median", "sd"))
```

Arguments

df	Data frame
by	Character vector of grouping columns
funs	Character vector of summary functions (kept for compatibility)

Value

Grouped summary data frame

`validate_wq` *Valida presenca de colunas minimas*

Description

Garante que o conjunto minimo de colunas exista no dataset.

Usage

```
validate_wq(
  df,
  required = c("ph", "turbidez", "od", "dbo", "nt_total", "p_total", "tds",
    "temperatura", "coliformes")
)
```

Arguments

`df`	data.frame/tibble de entrada.
`required`	vetor de nomes de colunas obrigatorias.

Value

O `df` de entrada se estiver valido; caso contrario, erro.

`wq_demo` *Demo water quality dataset*

Description

A tiny example dataset used in examples and the vignette. Columns are aligned with the package functions (Portuguese variable names).

Usage

```
data(wq_demo)
```

Format

A data frame with 20 rows and 11 variables:

ponto chr, monitoring point id

data Date, sampling date

ph numeric

od numeric, dissolved oxygen (mg/L)

turbidez numeric, NTU

dbo numeric, mg/L

coliformes integer, MPN/100 mL

p_total numeric, mg/L

nt_total numeric, mg/L

temperatura numeric, Celsius

tds numeric, total dissolved solids (mg/L)

Source

Simulated for package examples.

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